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ABSTRACT

This issue contains eight articles that represent information on a variety of highly specialized topics involving communicative sciences. Articles include: (1) "The Reliability of the Kay Elemetrics Multidimensional Voice Program (MDVP) for Acoustic Analysis of the Normal Voice" (Ann Marie Cimino and Christine M. Sapienza), which focuses on the reliability of using the Multidimensional Voice Program for objectifying normal and abnormal voices; (2) "A Case Study of an Adolescent African American English Dialect Speaker with a Language Disorder" (Linda I. Rosa-Lugo, Kenyatta O. Rivers, and Dona L. Hedrick), which highlights the differentiation of the disorder for the variation in dialect; (3) "Matching Stuttering Therapy Procedures with Clients: A Preliminary Investigation" (Dale F. Williams), which details the importance of matching the specific technique to the individual needs of the patient; (4) "A Case Example of a Bilingual Evaluation: A Tutorial" (Alejandro Brice and Celeste Roseberry-McKibbin), which presents a case study and details the necessary components of a comprehensive assessment; (5) "Voice and Swallowing Considerations after Laryngotracheal Reconstruction in Children" (William R. Spencer and Gary D. Josephson), which discusses the various surgical approaches to subglottic stenosis and possible voice and swallowing alterations; (6) "Genetic Hearing Loss in Children" (Gary D. Josephson and William R. Spencer), which presents an approach to many of the congenital and genetic syndromes that may involve hearing sensitivity; (7) "Evoked Otoacoustic Emissions as an Objective Screener for Ototoxicity" (Brenda L. Lonsbury-Martin, Bradford D. Ress, and Glen K. Martin), which presents the results of research in utilizing evoked otoacoustic emissions as an objective and highly sensitive indicator of damage from ototoxic drugs; and (8) "The Near-Total Laryngectomy and the Role of the Speech-Language Pathologist" (Lisa M. Proper), which describes the surgical procedures, expected voice and swallowing changes, and rehabilitation needs. (Articles include references.

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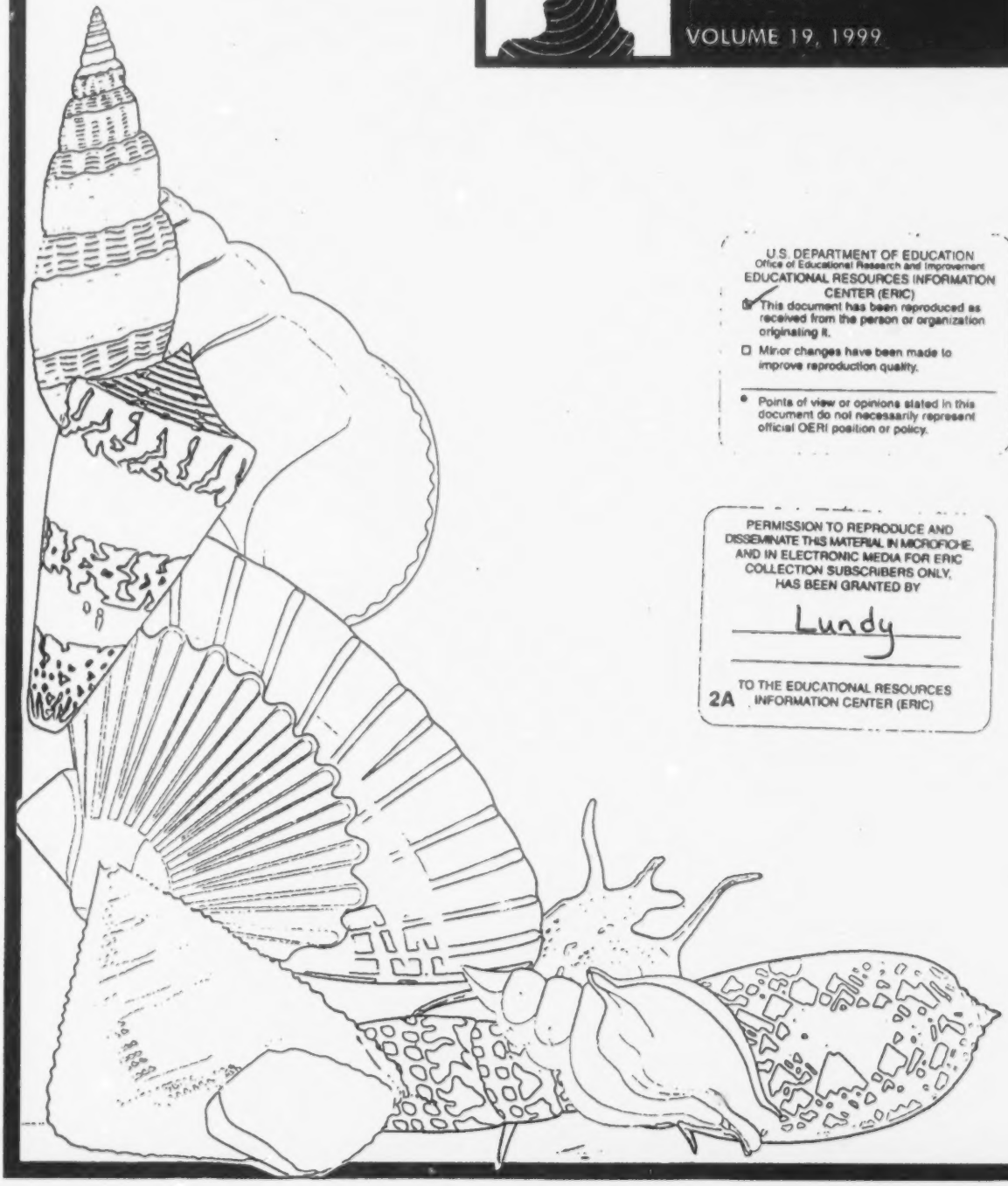

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FOREWARD

Welcome to the first *Florida Journal of Communication Disorders* of the 21st Century. We are extremely proud of the high quality of articles that are represented in this edition, and are hopeful that they meet your educational objectives. I would like to take this opportunity to thank the all-star review committee - - Chris Sapienza, Linda Lombardino, Kenneth Logan, and Alice Dyson - - who gave of their time, energy, and expertise to read and review the enclosed articles.

The eight articles in this edition represent information on a variety of highly specialized topics involving communicative sciences and disorders. There are three articles related to voice disorders. Cimino and Sapienza's article on the Kay Elemetrics Multidimensional Voice Program, a commonly used computerized voice analysis system, is an important one that focuses on the reliability of using the MDVP for objectifying normal and abnormal voices. Proper's article on the near-total laryngectomy is an excellent tutorial describing the surgical procedure, expected voice and swallowing changes, and rehabilitation needs. The Spencer and Josephson article on voice and swallowing considerations after laryngotracheal reconstruction discusses the various surgical approaches to subglottic stenosis and possible voice and swallowing alterations. There are two articles on language issues. The Rosa-Lugo, Rivers, and Hedrick article presents a case study of an adolescent African American English dialect speaker with a concomitant language disorder and highlights the differentiation of the disorder from the variation in dialect. Brice and Roseberry-McKibbin also present a case study in their article on bilingual evaluation and detail the necessary components of a comprehensive assessment. In addition, there is an excellent article on stuttering therapy procedures presented by Williams that details the importance of matching the specific technique to the individual needs of the patient.

This issue also contains two outstanding articles on audiologic issues. The Lonsbury-Martin, Ress, and Martin article on evoked otoacoustic emissions as an objective screener for ototoxicity presents the results of research in utilizing EOAE's as an objective and highly sensitive indicator of damage from ototoxic drugs. Finally, the article by Josephson and Spencer on genetic hearing loss in children presents an encyclopedia-like approach to many of the congenital and genetic syndromes that may involve hearing sensitivity.

We are again proud to offer you the opportunity to earn clinical credit hours by reading the *Journal*. FLASHA initiated this program in 1998 and it has proven to be a very successful method of obtaining credit for continuing education. To obtain the CEUs, you must simply read the articles and complete the application and multiple-choice questions in the attached booklet. We hope you find this a useful and convenient manner to receive continuing credit hours for reading the enclosed material.

So, please, enjoy Volume 19 of the *Florida Journal of Communication Disorders*.

Best wishes,

Donna S. Lundy

Vice President for Publications

The Reliability of the Kay Elemetrics Multi-dimensional Voice Program (MDVP) for acoustic analysis of the normal voice

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Acoustic analysis systems are frequently employed by speech pathologists to examine the vocal function characteristics associated with voice disorders. Acoustic analysis measures the frequency, timing, and amplitude of a voice signal. This method can be useful for differentially diagnosing between voice disorders, measuring the baseline vocal performance of a patient, or documenting the treatment outcome of voice therapy. Due to the increasing need to account for treatment effects, high reliability of instrumental output is essential for the valid measurement of voice characteristics. This study examined the intrajudge and interjudge reliability of *The Kay Elemetrics Multidimensional Voice Program* (MDVP). Several acoustic parameters were examined from sustained vowel samples produced by three speakers with normal voice. Three investigators within and across two distinct analysis sessions measured the parameters. Dependent variables included fundamental frequency, jitter, shimmer, and noise-to-harmonic ratio: measures commonly reported in the literature that are used to evaluate and define vocal function. Findings indicated no significant differences in any of the dependent variables as a function of speaker, measurer, or day of measurement. While this study represents an initial inquiry into the reliability of MDVP for the acoustic analysis of voice, the results suggest that it is a reliable measurement tool for examining normal voice production.

INTRODUCTION

The use of automated analysis programs for examining the characteristics of voice production has become part of the clinical management and empirical study of human communication. Clinically, speech pathologists use these programs as part of their standardized protocol by which the presence of a vocal condition or the improvement of vocal performance can be documented. Voice scientists use these programs within research protocols to quantify and distinguish the characteristics of both normal and disordered voice.

While information regarding the reliability of voice analysis systems is critical information to know as a user, unfortunately it is not often found in the manual associated with most programs. Reliability is the extent to which the same value is obtained if a measure is repeated (Doehring, 1996). A treatment technique can only be considered effective if a positive outcome is generated. Recently, defining treatment outcomes has become an increasingly critical issue for speech pathologists. Outcome measurements of voice production are a means by which improvements resulting from voice therapy can be documented. Accurate documentation of treatment outcomes rely on the application of reliable methods. Like research findings, treatment outcome data must be reliable in order to generate valid conclusions that can be duplicated and generalized.

There is some basic information on the capabilities and requirements of available voice systems that are used to measure the acoustic features of voice production. Read, Buder, and Kent (1990) conducted a survey of seven commercially available speech analysis systems. The systems they reviewed included: *CSpeech* (Milenkovic, 1990), *CSRE* (Canadian Speech Research Environment), *ILS-PC* (Interactive Laboratory System), *MSL* (Micro Speech Lab), the *Kay 5500 Sona-Graph*, the *Kay 7800 Sona-Graph*, and *Mac Speech Lab II*. In their report on these systems, the authors provided specific information about each system. Product applications and limitations were provided to benefit prospective purchasers (clinicians, professors, and researchers). Recommendations were made for the development of the next generation of acoustic analysis systems. However, the reliability of each system in obtaining the acoustic measurements was not discussed.

As a follow-up to their previous study, Read, Buder, and Kent (1992) again evaluated seven commercial speech analysis systems. The systems assessed included: *CSpeech* (Milenkovic, 1990), *CSRE* (Canadian Speech Research Environment), *ILS-PC* (Interactive Laboratory System), *MSL* (Micro Speech Lab), the *Kay 5500 Sona-Graph*, *Mac Speech Lab II*, and *Signalyze*. In this report Read et al. (1992) discussed the advantages and disadvantages of each system in a format that allowed comparison among various computer applications. Performance characteristics of each system were described and compared, including: system components, basic capabilities, user interface, data formats and journaling, speed and precision of spectral analysis, speed and precision of fundamental frequency analysis, and documentation. However, reliability of the systems was not addressed.

Karnell, Scherer, and Fischer (1991), compared the *VisiPitch* PC system to two systems based on minicomputers in three distinct voice labs, what one might consider to be called inter-system reliability. Jitter measures were shown to be unreliable between the VisiPitch and the two-minicomputer systems. This work showed that although comparable hardware and software used at independent laboratories can yield equivalent findings, "differences in recording hardware as well as recording and analysis procedures can result in important differences in perturbation findings" (Karnell, Scherer, & Fischer, 1991).

The measurement reliability of fundamental frequency, jitter and shimmer measured by three systems, The *Voice Analysis Program* (Kay Elemetrics) on the *Kay 5500 DSP SonaGraph*, *CSpeech* on an AT compatible computer (Zenith, model Z-200), and the *AUDED/SEG* program on a digital LSI 11-23 were also completed (Karnell, Hall, & Landahl, 1995). Results of this study showed that when standardized recording and analysis procedures were used, acoustic analysis systems generated results that were highly correlated for fundamental frequency. However, measurements of frequency and amplitude perturbation were not in agreement.

More recently, Bielamowicz, Kreiman, Gerratt, Dauer, and Berke (1996) studied the intrasystem and intersystem reliability of four voice analysis systems: *CSpeech*, *CSL* (Computerized Speech Lab), *Sound Scope*, and a hand marking system (developed at the VA West Los Angeles Voice Laboratory). Measures of fundamental frequency,

jitter, shimmer, and signal-to-noise/noise-to-harmonic ratio (SNR/NHR) were compared from vowel productions. The apriori assumption was that computer-based algorithms should always produce identical results under identical conditions. On the contrary, the results of this investigation showed the reliability of jitter, shimmer, and SNR/NHR to be affected; a result of each system offering different software options for the analyses. For example, the *CSL* tolerated more variation in the calculation of perturbation measures (1 ms versus 20 ms tolerance). *CSpeech* enabled the user to analyze whole signals or to divide each signal into a number of tokens (1 versus 10 tokens). Users were advised that changing analysis settings within a system changes the method by which perturbation is calculated, affecting the intraprogram reliability. For reliable outcomes, identical analysis settings must be maintained, particularly if a sample is to be analyzed on later occasions. Interprogram reliability will be affected by the fact that each system computes amplitude and frequency variations using different algorithms and provides results in different units. For example, if the same speech signal is input into different systems and distinct computations are used to measure jitter, shimmer, and SNR/NHR, the reliability will be reduced. Fundamental frequency appears to be the only comparable measurement across systems because its calculation is more basic and repeatable (Bielamowicz, Kreiman, Gerratt, Dauer, & Berke, 1996).

New acoustic analysis systems appear on the market quite readily. One measure of a system's measurement consistency is its reliability. As mentioned before, this information is often not included in the system's operating manual. The *Kay Elemetrics Multidimensional Voice Program* (*MDVP*) is a fairly current and highly promoted software program which is capable of acquiring, analyzing, and displaying up to 33 parameters from a single vocalization. *MDVP* provides numerical analysis and graphical display of voicing parameters using acoustic analysis techniques. The program became available as an additional component of the *Computerized Speech Lab* (CSL) hardware package in 1993. Researchers and clinicians have since begun to implement measurements made by the *MDVP* system into evaluative and experimental protocols. In order for these measures to be used confidently for detailing acoustic phonatory characteristics, the reliability of the instrument requires consideration.

This study was designed to examine the intrameasurer and intermeasurer reliability of *MDVP*. Several acoustic parameters were examined from sustained vowel samples produced by participants with normal voice. These included fundamental frequency, jitter, shimmer, and noise-to-harmonic ratio, dimensions commonly used by speech pathologists to evaluate and define disordered voice. These acoustic measures were chosen because of evidence to their reliability when computed by other analysis systems (Bielamowicz, et. al., 1996; Karnell, et. al., 1991; Karnell, et. al., 1995). Based on the findings of these studies, it was hypothesized that fundamental frequency would be a more reliable measure than jitter, shimmer, or noise-to-harmonic ratio. In addition, intrameasurer reliability was expected to be better than intermeasurer reliability for all measures.

METHODS

Participants

Three female graduate students from the Department of Communication Sciences and Disorders at the University of Florida, with a mean age of 22 years, participated in this study. All three participants demonstrated normal speech, language, hearing, and voice characteristics. None of the participants received prior speech or voice training. At the time of recording, all subjects denied the absence of cold, allergy, and flu symptoms. The voice samples produced by the three participants were acoustically analyzed using *MDVP*. Three measurers to determine intrameasurer and intermeasurer reliability completed the acoustic analysis of the stimuli.

Equipment and Speech Tasks

The acoustic signals were recorded using a Sony Digital Audio Tape (DAT) Recorder (Model 690) with an amplified (Model DBX 707) cardioid-type, unidirectional headset microphone. The microphone was placed four centimeters from the right corner of the participant's mouth as recommended by Titze & Winholtz, 1993. The microphone placement was maintained for all recordings of the participants' voices. Each participant was asked to sustain the vowel /a/ three times, for five seconds, at a comfortable effort level as per the protocol suggested by Brown, Morris, & Murry, 1996.

Acoustic Analysis

A total of nine samples (three participants x three vowel trials) were analyzed using *MDVP's* (model 4305) computer generated analysis for sustained phonation. Each judge individually analyzed all nine samples on two separate occasions, one week apart. The sampling rate was set at 25 kHz for all samples and appropriately anti-aliased using Kay Elemetrics built in filtering options. The entire vowel production was analyzed for each sample and by each measurer.

Four parameters were examined to assess the reliability of the computer-generated measurements. These parameters included fundamental frequency (F_0) and three perturbation measures, jitter (Jitt), shimmer (Shim), and noise-to-harmonic ratio (NHR). According to *4.0 MDVP* user manual provided by Kay Elemetrics, F_0 (Hz) measures the average fundamental frequency, or periodicity, for all extracted pitch periods of an acoustic signal. Jitt (%) is an evaluation of the variability of a pitch period within an analyzed voice sample. The measure represents the relative, short-term, period-to-period variability of the voice. Shim (%) is an evaluation of the variability of the peak-to-peak amplitude within an analyzed voice sample. The measure represents the relative, short-term, period-to-period variability of the voice. NHR is a general evaluation of the amount of noise present in the analyzed signal and is the average ratio of energy of the interharmonic components to the harmonic components.

STATISTICAL ANALYSIS

A repeated measure Analysis of Variance (ANOVA) was performed as a function of measurer and as a function of day for each of the dependent variables.

Results

The mean F was 192.9 Hz with a standard deviation of 6.2 Hz. When the ANOVA was applied to the data, as a function of day, $F = .68$, $p = .497$ and as a function of judge, $F = 1.06$, $p = .427$. There was no significant interaction between day and judge ($F = .84$, $p = .496$). The mean jitter (Jitt) was 2.0 with a standard deviation of 1.7. No significant difference was found for Jitt as a function of day ($F = 1.70$, $p = .323$) or judge ($F = .91$, $p = .472$). When the relationship between day and judge for the vowel samples was tested for Jitt, no significant difference was

found (F =.73, p =.537). The mean shimmer (Shim) was 3.8 with a standard deviation of 2.5. No significant difference was found for Shim as a function of day (F =3.23, p =.214) or judge (F =.46, p =.662). When the relationship between day and judge for the vowel samples was tested for Shim, no significant difference was found (F=.21, p =.701). The mean noise to harmonic ratio (NHR) was 0.13 with a standard deviation of 0.03. The ANOVA revealed no significant difference for NHR as a function of day (F =1.99, p =. 293) or judge (F =.55, p =.614). As well, no significant interaction between day and judge was found (F =.25, p =.789).

DISCUSSION

This study was a preliminary investigation into the reliability of the software program *MDVP*, developed by Kay Elemetrics Corp. *MDVP* is a software option for the *Computerized Speech Lab (CSL)*, which provides a quantitative assessment of voice quality. *MDVP* is capable of automatically extracting acoustic parameters from either sustained phonation or continuous speech. This paper examined the intrameasurer and intermeasurer reliability of the sustained phonation analysis option. Since the availability of *MDVP* as an option to *CSL* in 1993, an experimental study of its reliability has not been reported in the literature. This is unfortunate since the valid utilization of *MDVP* in the clinical and research setting is a function of its reliability of measurement. On a web page (www.kayelemetrics.com/mdvp.htm) developed by *MDVP*'s manufacturer (Kay Elemetrics), extensive field testing with normal and disordered voices using the MDVP program is referred to but data regarding the reliability of the program is not available.

In the current study, the constancy of this instrument for measuring vocal performance was tested using three speakers with normal voice. In order for the data to be more readily applicable, two situations relative to clinical and experimental data analysis were applied to test the reliability of MDVP. First, three distinct measurers analyzed all of the voice samples. Second, each of the measurers analyzed the same samples on two separate occasions, less than a week apart. The reliability of four measures (F_0, Jitt, Shim and NHR) from vowel production was examined across each measurement condition. The measures chosen for study are common to both the experimental and clinical literature dedicated to the study of voice.

The data collected during this study showed that all four measures were reliable, based on the lack of statistical differences in the data set. Specifically, the ANOVA revealed no significant differences for any of the variables across either measurement condition (judges and days). These results indicate that *MDVP* can be considered a stable research and clinical tool for the assessment of normal voice. Given that the vowels produced in this study were by those with normal voices, generalization of these results cannot be extended to the disordered voice.

Patients presenting with voice disorders bring a different challenge to the question of the reliability of a measurement system. Voice disorders change the phonatory function of the vocal mechanism, resulting in alterations to laryngeal function and/or the resonance characteristics of the upper vocal tract. For example, the disordered voice is often fraught with aperiodic segments which makes the voice signal much more difficult to consistently analyze. In order to explore the reliability of the *MDVP* system in the examination of disordered voice production, patient populations presenting with a variety of voice disorders must be studied.

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A Case study of an adolescent African American English dialect speaker with a language disorder

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The speech-language skills of an African American adolescent male who was a dialect user with a language disorder were investigated in this study. Despite showing communication deficits during conversational speech, Jamal had never been identified as needing speech-language services within his school district. The present researchers explored factors that contributed to his lack of identification. Recommendations are provided for identifying adolescents with speech-language disorders, including students from culturally and linguistically diverse backgrounds.

INTRODUCTION

An important challenge facing speech-language pathologists (SLPs) when evaluating language disorders in adolescents is the selection of assessment instruments and procedures that are appropriate for adolescents from culturally and linguistically diverse (CLD) backgrounds (Mitchener-Colston, 1996). African American English (AAE) dialect speaking students have been penalized in the past for their usage of a nonstandard English on formal language assessment instruments that were constructed and standardized for Standard American English (SAE) speakers (Mitchener-Colston, 1996; Stewart, 1981; Terrell & Terrell, 1983a; Vaughn-Cooke, 1983, 1986; Washington, 1996; Wyatt, 1998).

Researchers have shown that the majority of formal language assessment instruments include stimuli, prompts, and scoring procedures that are more reflective of SAE linguistic features and patterns than of nonstandard American English (NSAE) dialects, including AAE (Wyatt, 1998). Further, these instruments usually require response patterns that are inconsistent with AAE dialect speakers' linguistic styles and cultures (Taylor & Payne, 1983; Vaughn-Cooke, 1986). As a result, a disproportionate number of African American students appear to be referred and enrolled in exceptional education programs (e.g., learning disabilities classes; language delayed/deficit classes) based on their performances on standardized instruments that are inadequate and insensitive for evaluating the rich linguistic systems of students who are AAE dialect speakers (Craig, Washington, & Thompson-Porter, 1998; Mitchener-Colston, 1996).

School districts may now be underidentifying AAE dialect speakers who have language disorders in an attempt to reduce decades of criticism for having potentially overidentified African American students for exceptional education services (Craig & Washington, 1994). While SLPs and educators have made a concerted effort to better understand the features of AAE, many of them still have difficulties in differentiating "language deficits" from "language differences" in AAE dialect speakers. Their quandary may reflect their lack of understanding of the terms "deficit" (or "disorders") and "difference" (Beaumont & Langdon, 1992; Seymour, Bland-Stewart, & Green, 1998).

Seymour et al. (1998) suggested that the term "language deficit" be used to refer to clinically relevant language behaviors that are displayed by individuals, not linguistic systems (e.g., dialects) while the term "language difference" be used to refer to linguistic variations or styles of language systems that are used by a specific group of people (Beaumont & Langdon, 1992; Seymour et al., 1998; Wolfram & Christian, 1989). Speakers of language different systems, including AAE, typically use linguistic features and structures that are consistent with the norms of their communities, but may vary from the linguistic features characteristic of SAE (Seymour et al., 1998; Wolfram & Christian, 1989). The number and type of features that a dialect speaker uses can be heavily influenced by factors such as geographical location, educational level, socioeconomic status, ethnic background, gender, and age. Dialect speakers do not have difficulty communicating while individuals with language disorders are usually restricted in their abilities to initiate and complete successful communication exchanges with other people within their community (Damico, 1991; DeBose, 1992; Ratusnik & Koenigsknecht, 1976; Terrell & Terrell, 1993a; Washington & Craig, 1994, 1998). Therefore, SLPs should consider the linguistic norms of an AAE dialect speaker's community when making decisions about the appropriateness or inappropriateness of the speaker's linguistic skills (Wolfram & Christian, 1989).

A particular challenge that SLPs encounter when diagnosing language deficits in adolescents is selecting speech and language instruments and procedures that are appropriate to use with this population. SLPs frequently complain that the task of identifying and assessing communication skills and deficits of the adolescent population is an arduous, challenging, and ambiguous process. A number of SLPs have asserted that (a) minimal information is available in the literature regarding normal language acquisition from early school age to adolescents; (b) university training programs in communication disorders provide less instruction and experiences in evaluating adolescents than with younger populations; (c) few formal language assessment instruments are available for identifying and specifying language disorders in adolescents; and (d) service delivery models for remediating language deficits of adolescents in some settings (i.e., public school systems) are often inadequate for addressing the specific needs of this population (McKinley &

Lord-Larson, 1985; Mitchener-Colston, 1996).

Within the past two decades, researchers have made concerted efforts to identify and describe the language skills and disorders of adolescents. Moreover, they have proposed "best practice" guidelines for conducting valid and comprehensive assessments of the language skills of this population (Damico, 1993; Lord-Larson & McKinley, 1995; McKinley & Lord-Larson, 1985; Mitchener-Colston, 1996; Nelson, 1993; Nippold, 1988). Their recommendations specify that SLPs use assessment procedures that are authentic, functional, and descriptive (Damico, 1991, 1993); use both formal and informal assessment strategies for evaluating oral language proficiency and reading and writing skills (McKinley & Lord-Larson, 1985; Mitchener-Colston, 1996; Paul, 1995); collect data and information from classroom teachers using a variety of evaluation methods and tools (e.g., teacher perception questionnaires, consultations) to ascertain information about an adolescent student's language performance during in-class discussions and during reading and writing assignments (Boyce & Lord-Larson, 1983; Damico & Oller, 1980; O'Connor & Eldredge, 1981); and collect detailed information about the impact of various environmental factors on adolescents' language performance (e.g., home, school) (Ehren, 1994; McKinley & Lord-Larson, 1985; Nelson, 1993).

Maxwell and Wallach (1984) asserted that adolescents who are permitted to progress through their secondary education years without adequate language skills are at great risk for increased academic failures and decreased social opportunities. Similarily, McKinley and Lord-Larson (1985) and Terrell and Terrell (1983b) conclude that adolescents who graduate from high school with insufficient or limited speaking, listening, writing, and reading skills are at greater risk for having fewer self-determination opportunities and vocational choices than their peers with adequate language skills.

While SLPs must consider a variety of issues when diagnosing language deficits in adolescents, additional considerations must be made when the language skills of AAE dialect speaking students are being assessed. SLPs must recognize that AAE dialect speakers may display verbal and nonverbal behaviors that are consistent with their cultural and linguistic systems and that AAE dialect speakers' linguistic skills may vary depending on task requirements (Mitchener-Colston, 1996). Moreover, SLPs must consider assessment procedures that will differentiate linguistic patterns and features that are characteristic of AAE or extrinsic factors (e.g., culture, socioeconomic status) from linguistic behaviors that are exemplary of a language/learning deficit (Damico, 1991; Kovarsky, 1992; Wyatt, 1998).

Researchers have proposed that the evaluation process for AAE dialect speaking students should include the following components: (1) use of descriptive and criterion-referenced assessment techniques (e.g., rating scales, language sampling during conversational discourse, reading and writing sampling, direct observations) while the student is participating in a variety of linguistic activities (Damico, 1991; Washington, 1996); (2) use of analysis procedures that identify impairments in phonology and morphosyntax that are noncontrastive between AAE and SAE (Seymour et al., 1998); and (3) inclusion of formal and informal observations and data collected by caregivers, teachers, and other professionals regarding an AAE dialect speaking student's language skills that can specify factors which may have facilitated or have maintained problematic language patterns (Damico, 1991; Vaughn-Cooke, 1986; Wyatt, 1998). When standardized tests that have been normed on SAE dialect speakers are used with AAE dialect speaking students, Wyatt (1998) recommended that stimulus items be eliminated that could potentially be biased against the students, additional time be permitted for the students to respond, both verbal and nonverbal responses produced by the students be recorded for further analysis, and alternate scoring procedures be used to enhance descriptions of the students' performance.

The purpose of this case study is to describe a framework for differentiating a language difference from a language disorder in an adolescent AAE dialect speaker.

METHOD

Subject Description

The participant in the case study, Jamal (a pseudonym), was a 17 year-old African American male enrolled as a junior in an urban Florida high school comprised of approximately 60% African American students. Jamal was initially identified as an individual who might have a language disorder during his participation in a separate study on the code-switching abilities of African American adolescent males. This initial assessment was based on two conversational exchange samples of approximately 25 minutes each.

Jamal's frequent use of incomplete and fragmented sentences and vocal interruptions (e.g., pauses, hesitations, revisions, starters) were characteristic of disordered language. However, he also used many features of AAE, particularly in his phonological productions. For example, he consistently used the phonological processes of cluster reduction (e.g., "jus" for "just"), syllable reduction (e.g., "praly" for "probably"), and stopping (e.g., "dat" for "that;" "wit" for "with"). He was also observed to use a variety of regional semantic constructions (e.g., "chill," "I'm all wit dat") and phonological variations including fronting of some sounds (e.g., "nothin" for "nothing") and the substitution of some vowels (e.g., "thang" for "thing;" "ta" for "to;" "git" for "get"). The AAE and regional dialect linguistic features that he used were characteristic of those features used by the other participants in our larger study.

Information about Jamal's academic and social development was based on his self-report and data obtained from his cumulative folder. He was living with a female cousin with severe mental dysfunctions who had been designated as his legal guardian. He resisted talking about his biological parents saying only that he was unaware of their whereabouts. No information was available in his cumulative folder regarding his developmental or medical history; however, his academic history revealed that he had maintained regular attendance throughout his school years.

Despite his caregiver/living situation, Jamal was well-groomed and dressed. He informed us that he purchased his clothes by spending money earned as a bagger at a local supermarket and from summer jobs. He viewed school as a consistent factor in his life. He was courteous and respectful when interacting with school personnel and with us.

A review of Jamal's cumulative records revealed that he had never received speech or language services nor had he been identified by school personnel as needing such services. In fact, he had never been identified as needing any exceptional education services although his grades from elementary through high school revealed low academic achievement (primarily "D's" or "F's"

with occasional "C's" in core academic subjects). Yet, on national scholastic achievement tests administered by his school district, he performed within the low average to average range for his chronological age- and grade-level.

Data Collection

In the authors' larger study, nineteen African American adolescent males were randomly selected from all African American males in their high school who had a class standing of sophomore or junior. Their school records revealed no previous history of language disorders nor any previous history of having received exceptional education services. Each student provided parental- and self-permission before participating in the study.

The students participated in two conversational conditions. In both conditions, the students selected one of four topics (e.g., music, sports, social issues, school issues) to discuss individually with two African American male conversational partners who were in their early 30's. In condition 1, the conversational partner (C1) was a university professor who used Standard American English (SAE). In condition 2, the conversational partner (C2) was a graduate student who had been reared in Detroit, Michigan during his childhood and who consistently spoke AAE throughout his childhood and during his adulthood. C2 used AAE linguistic patterns and features with each student during the study. The order in which the participants talked with C1 and C2 was random.

The conversational exchanges were video- and audio-recorded. The samples were initially transcribed orthographically by a graduate and an undergraduate student assistant until a total of 300 words had been transcribed. The student assistants had been trained by the researchers in orthographic transcription of SAE and AAE dialects. Following the orthographic transcription of the samples, the samples were transcribed phonetically. The audio recordings of the conversational exchanges were replayed until consensus was achieved among the transcribers, which occurred during both the orthographic and phonetic transcription activities. If necessary, the video recordings of the conversational exchanges were used until consensus was achieved. Examples of Jamal's conversational exchanges with C1 and C2 can be seen in Appendix A and B, respectively.

The 300 transcribed words obtained during Jamal's conversational exchanges were used to analyze his conversational skills. This methodology was used due to the difficulties in determining utterance boundaries in older school age children and adults, which is consistent with the methodology used by Klecan-Aker and Hedrick (1985). It should be noted that the 300 word transcriptions were equivalent to 45 to 50 utterances.

Additional procedures were selected to ascertain the presence of a speech and language disorder in Jamal following "best practice" recommendations for assessing adolescents and AAE dialect speakers as discussed by Damico (1991), McKinley and Lord-Larson (1985), Mitchener-Colston (1996), and Wyatt (1998). Both formal and informal procedures were included in the assessment protocol as suggested by Mitchener-Colston (1996). Although a formal speech evaluation was not conducted, we analyzed Jamal's speech skills within the context of his conversational exchanges.

The formal and informal procedures used were as follows:

1. **Analysis of the conversational samples obtained in the larger study.**

a. **AAE feature analysis.** Jamal's linguistic features in terms of AAE features were analyzed as outlined by Seymour et al. (1998), Craig et. al. (1998), and Wyatt (1995). In addition, each of his conversational exchanges were coded for usage of various regional features.

b. **T-unit analysis.** This analysis procedure was used to obtain information about Jamal's clause usage, which is an indice of syntax construction for which data is available for adolescent speakers (Walker, Hardiman, Hedrick, & Holbrook, 1981; Loban, 1976). In addition, the *Test of Word Finding in Discourse* (TWFD; German, 1991) was used, which uses T-units as the basic measure for assessing a speaker's speech interruptions.

c. **Type-token ratio (TTR) analysis.** This analysis procedure was used to ascertain information about the diversity of the words used by Jamal during both of his conversational exchanges. TTR is also an indice of semantic skills for which average usage for adolescent speakers are available (Templin, 1957; Walker et al., 1981).

d. **Fluency, voice, and articulation observations.** Jamal's speech interruptions were analyzed for a potential fluency disorder using his two conversational samples. These samples were also used to screen for voice and articulation proficiency.

2. **Written discourse analysis.** Jamal was asked to write for twenty-five minutes on a topic of his choice. He chose the topic "Today's Fashions." His writing sample was analyzed for clause usage, which allowed a comparison to be made between his oral and written language abilities.

3. **Formal tests of language.** The State of Florida eligibility requirements for receiving language services in the public schools include a criterion that a student must obtain a test score of greater than 1.5 standard deviations below the mean in two or more components of language (semantics, syntax, pragmatics, phonology, morphology) (Florida Department of Education, 1995). Therefore, the authors chose to administer the *Woodcock Language Proficiency Battery-Revised* (WLPB-R; Woodcock, 1991) and the *TWFD* since they both provide normative and descriptive information about adolescent students' oral language, reading, and writing skills. While local norms were not available for either standardized test, they were administered to describe Jamal's language strengths and weaknesses and to support variations in his language performance within the academic setting. The *WLPB-R* can be used to substantiate language disorders in adolescents in school settings.

4. **Self-perception and teacher questionnaires.** Two questionnaires of communicative effectiveness, a student self-perception questionnaire and a teacher referral questionnaire, were included in the assessment protocol (Florida Department of Education, 1995). The teacher referral questionnaire was completed by Jamal's English teacher.

RESULTS

Results of the assessment procedure indicated that Jamal had disordered expressive language and supported his eligibility for speech and language services in the Florida public school system. Our findings are presented within the framework of the diagnostic questions that we posed as we attempted to identify (1) whether Jamal's speaking style was reflective of a language difference or a language disorder and (2) whether Jamal was eligible for speech or language services if a disorder was confirmed.

Table 1. Category, number, and percentage of African American English and regional features used by Jamal in conversational dyads of approximately 300 word (or 50 utterances) with Conversational Partner 1 (SAE) and Conversational Partner 2 (AAE).

AAE and Regional Dialect Features	Conversational Dyads					
	Conversational Partner 1 SAE Speaker			Conversational Partner 2 AAE Speaker		
Linguistic Features	# of Features Used	% of AAE Feature Usage	% of Regional Feature Usage	# of Features Used	% of AAE Feature Usage	% of Regional Feature Usage
Morpho- syntactic	21	33%	67%	11	55%	45%
Phonological	55	71%	29%	20	45%	55%
Total Features Used	76			31		

Is Jamal an AAE speaker?

Jamal's two conversational samples were analyzed in terms of AAE and regional dialect feature usage. As can be seen in Table 1, the frequency and percentage of AAE and regional features varied within the two conversational conditions. He used 76 features with the SAE dialect speaker (C1) while using 31 features with the AAE dialect speaker (C2). He used a greater percentage of AAE phonological features (71%) and a smaller percentage of AAE morphosyntactic features (33%) with C1, while only using a slightly higher percentage of AAE morphosyntactic features (55%) than AAE phonological features (45%) with C2. Cluster reduction, stopping and deletion of initial consonants were examples of the most frequently used AAE phonological types produced with both C1 and C2 speakers. Fronting and vowel substitution were the most frequent regional phonological types used by Jamal and his peers. AAE morphosyntactic features included double negatives, invariant "be," and deletion of auxiliaries. Regional morphosyntactic features included subject-verb agreement differences and the use of the word "like" as a copula.

Jamal is an AAE speaker as substantiated by his rating of "2" using Wyatt's (1991) *African-American English Rating Scale*. Wyatt's (1991) scale ranges from "1" ("heavy usage of AAE features") to "7" ("no evidence of AAE feature usage"). Samples of Jamal's language skills with C1 and C2 are shown in Appendix A and B, respectively.

Does Jamal evidence a speech-language disorder?

Speech: Jamal's phonological skills and voice quality were judged to be adequate and consistent for his age, sex, social, and cultural background. However, he displayed noticeable speech interruptions throughout his conversational samples.

Language: Word and phrase revisions or reformulations occurred most frequently (C1: 14 interruptions per 59 T-units; C2: 14 interruptions per 71 T-units), followed by word and phrase repetitions (C1: 16 interruptions per 59 T-units; C2: 25 interruptions per 71 T-units). Only one of the repetitions were of an initial consonant. Jamal used only four time fillers (i.e., vocalized pauses) during 40 minutes of conversation with C1 and C2. Stuttering was ruled out as a contributing cause of his speech interruptions based on (1) the types of interruptions produced, (2) the absence of any secondary characteristics associated with the act of speaking, and (3) Jamal's self-perception of his speech skills.

Differences were seen in Jamal's utterance lengths during the two conversational exchanges. His average number of words per T-unit was 9.20 and 7.59 with C1 and C2, respectively. These scores were within or slightly below the T-unit average range for young adults (18- to 20-year-olds) of 7.85 to 15.81 obtained by Walker et al. (1981) whose samples included white and black speakers and young adult speakers (18, 19, and 20 year-olds) from Florida. Kleecan-Aker and Hedrick (1985) reported an average length of T-units of 10.15 for ninth graders.

Jamal's average number of subordinate clauses per T-unit was 1.39 in both conversational exchanges, which is considered average using Walker et al.'s (1981) range of average performance (mean = 1.39; range = 1.06-1.72). These results suggested that Jamal's independent and dependent clause usage were adequate in both conversations. However, his clause lengths were suspect during his conversational exchange with the AAE dialect speaker.

In his writing sample, Jamal produced an average of 1.17 subordinate clauses per T-unit. Although the average number of subordinate clauses expected of eleventh graders is not available, Scott (1988) reported that the average number of subordinate clauses expected of tenth graders is 1.5 and of twelfth graders is 1.6. It appears that Jamal's score falls substantially below the scores expected of students in the tenth and twelfth grades.

Type-token ratios (TTR) were obtained to describe Jamal's word usage diversity. He obtained a TTR of .44 with C1 and .57 with C2. According to Walker et al. (1981), the average range for young adults is .54-.68. Thus, Jamal's TTR score of .57 with C2 fell within the range while his score of .44 with C1 fell below the range.

The *TWFD* was used to identify the severity of Jamal's word finding behaviors. As can be seen in Table 2, he displayed a high frequency of word finding difficulties with both conversational partners. The percentage of word finding behaviors per total number of T-units that he exhibited with C1 and C2 were 54% and 55%, respectively. These percentages were equivalent to a standard score of 64, which indicates a severe word finding problem.

The most noticeable difference in Jamal's conversations from those of his peers was the frequency of speech interruptions. He frequently used word and phrase repetitions and reformulations. German

Table 2. Total number of T-units, total number of T-units with one or more word-finding behaviors, mean number of words per T-unit, and standard scores produced by Jamal in conversational dyads with Conversational Partner 1 (SAE) and Conversational Partner 2 (AAE) using the *Test of Word Finding in Discourse* (TWFD).

Normative Score Summary	Conversational Partner 1 (SAE)	Conversational Partner 2 (AAE)
Total Number of T-units	59	71
Total T-units with One or More Word-Finding Behaviors	32	39
Mean Number of Words Per T-unit	9.20	7.59
Standard Score*	65*	64*

* Indicates that Jamal's discourse samples were obtained without using the stimulus pictures of the *TWFD*.

(1994) listed these as two characteristics of word finding difficulties in children along with insertions, empty words, and time fillers, which Jamal also exhibited. According to German (1994), Jamal fits "Profile 2," which represents adequate language production with word finding problems.

Results of the *WLPB-R* are presented in Table 3. The standardization sample of the *WLPB-R* included adolescent children from different ethnic backgrounds. Jamal showed average or above average performance on the oral and written vocabulary subtests (Picture Vocabulary, Oral Vocabulary, Reading Vocabulary) while displaying below average performance on the Listening Comprehension, Verbal Analogies, and Word Attack subtests. The latter subtests reflect behaviors that are consistent with academic concerns expressed by school personnel. His scores on the test showed variations in his language performance in specific language activities. His standard scores for the Oral Language and Broad Reading clusters indicated oral language, reading, and writing abilities that were below expected levels for his age and grade.

Table 3. Standard scores and stanines obtained by Jamal on the thirteen subtests, oral language cluster, and broad reading cluster of the WLPB-R and based on grade- and age-levels.

Woodcock Language Proficiency Battery - Revised (WLPB-R)				
	Standard Score		Stanine	
Subtest	Grade	Age	Grade	Age
Memory for Sentences	89	89	4	4
Picture Vocabulary	91	85	4	3
Oral Vocabulary	91	86	4	3
Listening Comprehension	76	75	2	2
Verbal Analogies	78	77	2	2
Letter-Word Identification	85	81	3	3
Passage Comprehension	86	82	3	3
Word Attack	75	76	2	2
Reading Vocabulary	89	84	4	4
Dictation	84	81	3	3
Writing Samples	107	102	6	5
Proofing	93	91	4	4
Writing Fluency	77	77	2	2
Oral Language Cluster	81	78	3	2
Broad Reading Cluster	84	80	4	3

The responses provided by Jamal on the student self-perception questionnaire and by his English teacher on the teacher referral questionnaire included responses that were consistent with a diagnosis of language disorder. On the student self-perception questionnaire, Jamal described himself as a student who was sensitive about his expressive language skills. For example, he disclosed that: (1) He did not feel that he made favorable impressions when talking to other people; (2) It was difficult for him to talk to "important" people (e.g., teachers, supervisors); (3) He found it difficult to look at his listeners when speaking to them whether or not they were peers or authority figures; (4) He found it easier to talk to younger conversational partners; and (5) He usually did not feel confident about his language skills in most speaking situations. On the teacher referral questionnaire, it was reported that: (1) Jamal avoided speaking in class; (2) He performed better in silent reading activities than in oral reading activities and that he had fluency difficulties (e.g., hesitations, prolongations); (3) He had trouble spelling words that we dictated to him; (4) He usually left out words when asked to repeat a number of words or sentences; and (5) He was aware of his communication problem. While the teacher expressed a variety of concerns about Jamal's language abilities, he had not referred Jamal for a language screening or evaluation. He stated to us that he did not view Jamal as being different from the other AAE dialect speakers in his classes.

Is Jamal eligible for speech-language services according to Florida's Department of Education's criteria for school age children?

Specific criteria of the Florida Department of Education (D.O.E.) [Florida Department of Education, Rule 6A-6.3411(2) (f), FAC] must be met to determine if a student older than five years is eligible for speech-language services in Florida's public school system. The criteria include: (1) the establishment of the existence of a language disorder, (2) the determination that Florida's eligibility criteria for speech- language services have been met (Florida De-

partment of Education, Rule 6A-6.03012), and (3) the determination that a language disorder would negatively impact the student's ability to profit from the academic curriculum, to interact with adults and peers, and to participate in vocational activities, collectively referred to as "educational relevance."

Regarding the first criterion, Florida's D.O.E. [Florida Department of Education, Rule 6A-6.3411(2) (f), FAC] mandates that the presence of a language disorder be established using standard scores from standardized language protocols. Scores must be more than one standard deviation below the mean for a student's chronological age. Jamal's performance on the *TWFD* (see Table 2) and on the *WLPB-R* (see Table 3) met this criterion. On the *TWFD*, he obtained a standard score of 65, which was more than two standard deviations below the mean.

The second criterion requires that a student have a language disorder, not a language difference. This criterion can be met by demonstrating that the student has "two or more, but not all, components of the language system rated as moderately or severely impaired using a language severity rating scale" (Florida Department of Education, Rule 6A-6.03012). Of the five language components (e.g., phonology, morphology, syntax, semantics, pragmatics), Jamal scored within the normal range on syntax, morphology, and phonology. He showed moderate to severe impairments in word retrieval (semantics) and pragmatics.

A communicative rating scale from the Florida D.O.E resource manual was used to rate Jamal's semantic abilities (Florida Department of Education, 1995). He obtained a rating of moderate to severe based on his performance on the *WLPB-R* and *TWFD*. He was also rated as having a moderate impairment in pragmatics based on his responses provided on the self-perception questionnaire and his increased usage of AAE linguistic features when talking with the SAE conversational partner.

The third criterion entails determining if the language disorder negatively impacts the student's academic achievements, social acceptance, and/or vocational potential (Florida Department of Education, 1995). His overall scores on national scholastic achievement tests from elementary to high school were typically higher than his classroom grades, and his scores usually fell within the low average to average range for his chronological age- and grade-level. It was obvious from Jamal's self-perception questionnaire responses and the teacher referral questionnaire responses that his language skills were affecting his academic skills. While he said that he was interested in being gainfully employed following school hours and during semester breaks, he commented that he was only able to secure jobs as a concession stand attendant or a bagger at grocery stores. These jobs require only minimal verbal skills, which suggests that his language deficits are affecting his vocational opportunities. Based on Florida's eligibility criteria, Jamal is eligible for language services in the public schools.

DISCUSSION

The results in this study support McKinley and Lord-Larson's (1985) contention that adolescents with communication disorders remain undetected, unserved, and underserved. Of great importance, there may be even a higher rate of under-identification when adolescents are AAE dialect speakers, especially in schools in which AAE dialect speakers comprise the majority of the student population.

There are a variety of factors that may influence school district policies and decisions to provide speech and language services to AAE dialect speaking adolescents with communication disorders. They include: (1) the paucity of services provided by SLPs to adolescents in general (McKinley & Lord-Larson, 1985); (2) the limited knowledge and skills SLPs have in assessing the communication skills of AAE dialect speakers and other CLD students (Damico, 1991; Huang, Hopkins, & Nippold, 1997; Wyatt, 1995, 1998); (3) the difficulties SLPs and school personnel have in differentiating language differences from language disorders (Beaumont & Langdon, 1992); and (4) an operating principle of many school districts that students with language deficits are usually identified at earlier grade- and age-levels; therefore, it is not necessary to screen adolescent children (McKinley & Lord-Larson, 1985; Tibbits, 1985).

While it appears that some SLPs have limited knowledge and evaluation skills about adolescents, a growing body of literature has emerged over the past several decades describing language development and disorders in adolescents (Alson & Swidler, 1976; Boyce & Lord-Larson, 1983; Damico, 1993; McKinley & Lord-Larson, 1985; Mitchener-Colston, 1996; Nelson, 1993; O'Connor & Eldredge, 1981; Tibbits, 1982; German, 1994). An increasing number of researchers have recommended techniques and strategies for identifying, assessing, and treating language disorders in adolescents (McKinley & Lord-Larson, 1985; Wiig & Semel, 1984). Moreover, assessment "best practice" guidelines and recommendations have also been developed for effectively evaluating CLD students (Craig et al., 1998; Damico, 1991; Mitchener-Colston, 1996; Seymour, Bland-Stewart, & Green, 1998; van Keulen, Weddington, & DeBose, 1998; Washington & Craig, 1994; Wyatt, 1998). However, it does not appear that this information has been fully integrated into the policies, practices, or procedures of speech-language pathologists (SLPs), teachers, administrators, and other personnel in many school districts.

If the school district in which Jamal is enrolled had applied appropriate screening procedures for identifying high school students with potential speech and language deficits (e.g., teacher referral questionnaires, self-perception questionnaires, and review of writing samples obtained from national scholastic achievement tests, term papers, journals), he would have been referred for appropriate services. It is our view that AAE dialect speaking adolescents who consistently fail in core academic subjects and who perceive themselves as having communication difficulties should be screened for possible speech and language deficits following "best practice" assessment techniques and strategies. They should be screened even when they are performing within the average to low average range on national achievement tests. We recommend that assessment protocols for AAE dialect speaking adolescents should include language sampling of communication skills across different conversational partners and in a variety of settings and situations.

In our case study, Jamal used markedly more AAE dialect morphosyntactic and phonological features when talking with the SAE dialect speaker. We describe this type of linguistic pattern as "reverse code-switching," because we observed that other participants in our larger study displayed more typical code-switching patterns. In other words, they used fewer AAE dialect features with the SAE dialect conversational partner than with the AAE dialect conversational partner. Since Jamal and the other participants were allowed to choose their own conversational topics, we are not

certain if their linguistic patterns were influenced by their interaction with either the SAE or AAE partners or by differences in conversational topics. It is possible that the linguistic pattern displayed by Jamal might occur more frequently in children with language disorders, in particular adolescents with language disorders. This linguistic pattern needs to be further investigated in future research to determine its replicability and its relatedness to differences in conversational topics, settings, and/or partners (e.g., ethnic background, age, gender, authority figure persona).

Jamal's communication deficits are not unique. There are many adolescents in high schools whose language skills will preclude them from succeeding in life. As professionals, we must design protocols for identifying and treating older children who have fallen between the cracks and who have failed to receive the language intervention needed to ensure academic and vocational success.

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APPENDIX A

Conversational Exchange Sample Between Jamal and the Standard American English (SAE) Dialect Speaking Conversational Partner

Jamal chose the topic "school issues" to discuss with the SAE conversational partner. The following is a segment of their conversational exchange:

SAE Partner: Okay. If I was working for the governor and he said I want you to go out and get three major concerns of African American teenagers in tenth grade and talk to the guys and after tell me what their three major concerns are. Now, what would you tell me? What would be one?

Jamal: First, I would tell them um lemme see how I'm gonna say this. They need start teaching real stuff. You know you know what I mean, right?

SAE Partner: Yeah. I know what you're talking about.

Jamal: More tuff (stuff) more that people like more be interested more in you know something like I on't (don't) you know something like um I on't (don't) know how to say it but mostly like Columbus or something like that you know what I'm saying?

SAE Partner: Well. Years ago your school had a pretty rough reputation. How is it now?

Jamal: It's still da (the) same reputation I had when I first came out to this school. Everyone was sayin' da (the) same reputation but I had heard the school that I had came transferred from caw (cause) I moved over here, right, and everybody her th they still have a strong reputation basically.

SAE Partner: And is that reputation good or bad?

Jamal: Bad.

SAE Partner: What caused that reputation to be like that?

Jamal: Basically the part the city the part of the city we in and all the stuff that goes over here.

APPENDIX B

Conversational Exchange Sample Between Jamal and the African American English (AAE) Dialect Speaking Conversational Partner

Jamal chose the topic "sports" to discuss with the AAE conversational partner. The following is a segment of their conversational exchange:

AAE Partner:	I think Chicago and the Heat gone play. But, then again, man, I don't know. New York lookin (looking) sort of tough too.
Jamal:	Allan Houston.
AAE Partner:	Yeah. Startin (starting) to come around, man.
Jamal:	Yeah. Starks be cuttin (cutting) up too. He got that little little award for best sixth man off the bench.
AAE Partner:	Well uh. Yo. Who you think who you think'll win between New York and Miami.
Jamal:	New York and Miami. Thats thats be a good one. That's a good one right there. I can't really say. Uh I'm hopin (hoping) I'm hopin (hoping) um Heat go over cause New York is okay but it I it ain't my. I on't (don't) like New York for some reason. I just like Heat. I like I like Zo.
AAE Partner:	Ah. Zo. Yeah, Zo. He can ball man. You know what I like. I like seein (seeing) Mashburn gettin (getting) off.
Jamal:	I can't believe I didn't know he got traded. I thought he was still with Dallas.
AAE Partner:	With Dallas?
Jamal:	Yo. That was somthin (something) right there.

Matching stuttering therapy procedures with clients: A Preliminary investigation

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Case report data were analyzed in an attempt to uncover relationships between effective stuttering treatment procedures and client characteristics. Such relationships were found for only client age. Specifically, indirect therapy involving a home program was reportedly successful with preschool children and, for children above this age range, the treatment plans associated with the greatest therapeutic progress included home programs, client self-monitoring, and transfer/maintenance.

INTRODUCTION

For years, researchers and theorists have described various differences among individuals who stutter (Borden, 1990; Van Riper, 1971; Williams & Brutten, 1994). For example, subgroups have been identified, based on the primary type of disfluency (Schwartz & Conture, 1988), the anatomical loci of disfluency (Borden, 1990), whether or not there is a family history of stuttering (Janssen, Kraaimaat, & Brutten, 1990; Poulos & Webster, 1991), and the presence or absence of concomitant speech, language, or learning deficits (Cullinan & Springer, 1980; Nippold, 1990). In addition to these groupings, subjects who stutter have been separated on the basis of severity. This follows from findings of physiologic and durational differences between samples differing in severity (Borden, 1983; Borden, Baer, & Kenney, 1985; Watson & Alfonso, 1987a, 1987b). Finally, differences in gender, age, intelligence, motivation, and other personal characteristics have also been examined (Bloodstein, 1981; Culatta & Goldberg, 1995; Kent, 1983; Yairi, Ambrose, Paden, & Throneburg, 1996).

While it seems possible that different subgroups of people who stutter would respond to different therapy approaches (Yairi, 1990), the heterogeneity across people who stutter is not, unfortunately, always reflected in its treatment. In published programs, stuttering tends to be managed uniformly (Keys & Ruder, 1992). Information about client suitability exists, but is limited. For example, certain treatments are reputedly appropriate for children (e.g., Courtright & Litchfield, 1994; Craig & Cleary, 1982; Emerick, 1970; Gregory, 1984; McKeehan & Child, 1990; Ramig & Bennett, 1995; Retzinger, 1991; Runyon & Runyon, 1986; Rustin, 1991; Stocker, 1976), others for adults (Andrews & Tanner, 1982; Hasbrouck & Lowry, 1989; Miller, 1994; Prins, 1984). In addition to age, therapy approaches have been tailored to individual clients on the basis of specific diagnostic data. Such approaches can involve a variety of speech targets, of which only those appropriate for a particular client are applied (Runyon & Runyon, 1986; Culatta & Goldberg, 1995). At least one treatment (Sacco, 1986) was designed for clients who stutter severely. Additional client-specific information is difficult to find and tends to be based on clinical experience, not empirical evidence.

It appears, then, that there is validity to Goldberg and Culatta's (1995) statement that a better way is needed to apply current therapeutic approaches to clients. At this point in time, unfortunately, there are few means of determining which therapy procedures are most appropriate for a given person who stutters. While it appears that stuttering therapy is generally successful, based on both research (Andrews, Guitar, & Howie, 1980; St. Louis & Westbrook, 1987) and client reports (Krauss-Lehrman & Reeves, 1989), a more efficient delivery of services would undoubtedly improve success rates. As a result of the difficulties in matching clients to appropriate therapies, much time is potentially wasted as therapists try different treatments until they either find effective techniques or their clients leave therapy. The inability to match clients and treatments might also explain why formal stuttering therapy programs rarely, if ever, claim success for all clients and why different therapeutic techniques are effective with different clients.

Possible methods for appropriately matching treatment procedures to client characteristics are numerous. For example, group studies and case reports are used to investigate the effectiveness of individual treatments (e.g., Boberg & Kully 1994; Williams & Wener, 1996). Longitudinal studies typically involve more variables than the aforementioned group and case examinations, but hold the disadvantages of being time-consuming and potentially biased due to loss of subjects (Neale & Liebert, 1986). These drawbacks are eliminated with retrospective studies of past case reports, but this type of investigation offers a different shortcoming in that relevant information may be missing from the available data. Even so, retrospection may well provide preliminary findings on which subsequent research can be based.

The purpose of this report was to utilize retrospection to begin the process of appropriately matching treatment procedures to client characteristics, thereby giving clinicians information to use in initiating individualized therapy plans. As such, treatment and client data were gathered through a review of case reports.

PROCEDURE

The cases used for this investigation included 20 former clients of the Florida Atlantic University-Communication Disorders Center (FAU-CDC), a clinical training facility, and published reports from elsewhere (Blood, 1995; Cooper, 1983; Craig & Cleary, 1982; Guitar, Schaefer, Donahue-

Kilburg, & Bond, 1992; Klassen, 1995; Martin, Kuhl, & Haroldson, 1972; Pill, 1988; Winslow & Guitar, 1994). The reported FAU-CDC clients were treated between the years of 1987, when the clinic opened, and 1998. These clients were all seen to the completion of therapy. Treatment was administered by graduate students in the Communication Disorders program and supervised by faculty and staff holding certificates of clinical competence in speech-language pathology. To accommodate students and supervisors, therapy sessions were 30 to 60 minutes in length, one to three times weekly. Because of these scheduling concerns, intensive therapy programs were not practicable in this setting. Such programs, then, are underrepresented in this analysis.

It was felt that both published and unpublished clinical reports would include the types of specific client and treatment information desired. Because case reports on stuttering are not numerous, and the variables under study in this investigation are many, reports listing any of the desired client traits were used. All potential groupings of people who stutter were investigated, as there is not yet a basis for determining that some subgroup designs are worthier of study than are others.

RESULTS

In total, 33 case reports were analyzed with respect to client traits and therapy procedures used. Success was described in terms of short term and long term goals met. The results are reported on Table 1. (See page 20).

Seven of the reported cases (clients 1 - 7) involved children aged zero to five years. Five of these children were males, two were females. Traits common to the children included repetitions as the primary disfluency, no additional disorders, and few associated behaviors, all reported four times. Severity ranged from mild to severe. Therapeutic progress was made with all seven of these children. Three (clients 2, 4, and 5) completely recovered, including both females. Indirect therapy (addressing stuttering without formal therapeutic techniques) with an accompanying home program was received by four of the children, including the three who recovered.

Clients 8 - 15 were school-aged males. Five of them (clients 9, 10, 12, 13, and 14) had been diagnosed with concomitant articulation disorders, one of these five (client 9) also presenting a language deficit. The most popular therapy techniques for this group were slowed speech rate, used seven times, and easy onset (any form of gentle speech initiation), which was utilized with four clients. Progress was reported with all eight of these clients, but only two progressed as far as their stated potentials (clients 8 and 11). Both of these clients received biofeedback, one electromyographic and the other delayed auditory feedback (DAF). Both therapy plans also included home programs, self-monitoring tasks, and transfer/maintenance. Of the remaining school aged subjects, only Client 15 was treated in a similar manner.

Six adolescent males (clients 16 - 21) also apparently made therapeutic progress, particularly the five from published case reports: Clients 16 and 17 (Craig & Cleary, 1982) and clients 19, 20, and 21 (Blood, 1995). Common to these five clients were self-monitoring tasks and transfer/maintenance, techniques also employed with the sixth adolescent, client 18.

The final twelve clients summarized on Table 1 were adults. Nine of these clients were male, three female. For only one (client 22) was another disorder, cluttering, reported. The therapy procedure used most often was easy onset, utilized with seven clients. Other popular techniques were home program, prolonged speech, and breathing procedures, all reported six times. Slowed speech rate and control of utterance length and complexity were both reported for five clients. For only one adult, client 29, were all long-term goals accomplished.

DISCUSSION

The most obvious inference one can draw from the accumulated data is that therapeutic improvement is likely during the course of stuttering treatment. In addition, it appears that this improvement can occur with any age client, although greater progression was noted with children than adults. Both conclusions are supported in literature on treatment efficacy (St. Louis & Westbrook, 1987). It is worth noting that, to the extent that published case reports are more likely than not to submit positive results, the data presented in this report may well be skewed toward therapeutic success. However, it is also true that positive treatment outcomes are evident in published research (Andrews, et. al., 1980; Krauss-Lehrman & Reeves, 1989; St. Louis & Westbrook, 1987). Moreover, progress was consistently noted in the unpublished case reports reviewed for the present investigation. Despite the general improvement across the subjects, however, the case report data also suggest that clients do not always progress to their maximum potentials. Such inconsistency indicates that, even with the reported success, treatment selection is still important.

While the reported results are generally consistent with present theory, caution is nevertheless advised in their interpretation. The progress reported in any one case is not necessarily the result of clinical intervention. Physiological maturation, increased motivation, and improved rapport with the therapist are but three of many factors that could impact recovery independent of the treatment techniques selected. It is hoped, but not guaranteed, that these factors affect the variables under test equally. Also, it is worth noting that there can be many definitions of clinical progress. The one used for the present study—meeting stated goals—is objective but somewhat limited because clients can progress greatly without accomplishing the therapist's objectives. It is possible, for example, that in some instances the stated goals were not the most appropriate for the particular client.

With respect to the stated purpose of the study, to better match therapy procedures to individual clients, the data offer no characteristics other than age to which clinicians can tailor treatment. Two factors hindered accomplishment of this purpose. One is that treatment goals were often not reached, particularly with adults, and therefore successful therapy procedures were difficult to identify. In addition, client traits were sparsely reported in many cases in which therapy goals were achieved. This scarcity of information prevented the drawing of firm conclusions. It is interesting to note, for example, that none of the clients who met their long term therapy goals were reported as presenting additional communicative disorders and, of those for whom concomitant deficits were identified, none reached their stated potentials. However, speech-language history was not consistently reported and, as a result, no real inferences can be drawn about its relationship to therapeutic success.

In sum, the notable findings emerging from these cases were 1) indirect therapy involving a home program successfully eliminated stuttering for three children under the age of six and 2) for children above this age range, the procedures associated

with the greatest success were biofeedback, home programs, self-monitoring, and transfer/maintenance. It is true that the children who recovered tended to be female and present no additional disorders, a result supported by previous research on recovery from stuttering (Yairi, Ambrose, Paden, & Throneburg, 1996). However, concluding that indirect therapy tends to work best for preschool children who are female or who only stutter is difficult, given the small number of female subjects and the fact that data were not examined for indirect therapy administered to children with concomitant disorders.

Indirect therapy was used with only the 0-5 age group. This use is appropriate, as the approach is based on the modeling of fluency enhancing behaviors, such as slowed speech, pausing, and turn-taking with children displaying behaviors consistent with the onset of stuttering (Williams, 1999). From the case report data, it is tempting to conclude that indirect therapy is the treatment of choice with children under the age of six. After all, progress was recorded in all four cases in which this approach was utilized, including complete recovery for three of the four. It should be pointed out, however, that therapeutic progress occurred with direct therapy for three other reported cases. Such progress with direct therapy has been recorded in other sources as well (McKeehan & Child, 1990; Shine, 1984).

The success reported with biofeedback is difficult to interpret. While an argument could be made for wider use of these techniques, it becomes somewhat difficult to justify when one considers that the types of biofeedback used to meet long-term goals, electromyographic (EMG) and delayed auditory, were likely successful for different reasons. EMG feedback was used by clients 8, 16, and 17 to monitor muscular tension associated with speech production (Craig & Cleary, 1982). Speaking under DAF promotes fluency without the client monitoring the feedback. Fluency results from either a forced change to a slower, more prolonged speech or because DAF alters auditory feedback of speech (Starkweather, 1987).

Less open to interpretation is the association between therapeutic success and the implementation of home programs. Such programs are considered to be important because the client is able to practice therapy targets regularly and also because practice at home initiates the process of transfer (Leith, 1993). Given these reasons for home practice, literature citing the importance of involving parents and/or other family members in treatment (e.g., Ramig, 1993) is justified.

In addition to home programs, client self-monitoring was common to treatment programs with reported success. In other words, clients who learned to recognize and self-correct errors made the most progress. Finally, transfer of therapeutic targets to environments other than the clinical setting and then maintaining a high performance in these settings were needed for long-term success. Fortunately, home programs, self-monitoring, and transfer/maintenance are all possible in a multitude of clinical settings.

Despite the support gained for indirect therapy, home programs, self-monitoring, and transfer/maintenance, the question remains whether stuttering clients can be matched to appropriate therapies on the basis of characteristics other than age. In order to determine if such matching can be done, more data are needed. One likely source of such data is additional case reports. Given the period of time that the FAU-CDC has been open, fewer client reports were available for the present study than would be accessible elsewhere. To facilitate the accumulation of appropriate data, clinicians are encouraged to document client traits and treatment progress. Accumulation of such information can aide in the process of matching treatment plans to clients and, in doing so, improve the efficiency and effectiveness of stuttering therapy.

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Table 1. Client traits, clinical procedures, and reported success associated with case reports.

	Client Traits	Procedures	Success
1	0 - 5 Primarily repetitions Positive family history No other disorders Few associated behaviors Male	Indirect therapy Video/Audiotaping	Increased fluency reported, but no long term goals listed.
2	0 - 5 Primarily repetitions Positive family history No other disorders Few associated behaviors Male	Indirect therapy Home Program	Complete recovery from stuttering.
3	0 - 5 Primarily repetitions Articulation, voice disorders Mild stuttering Previous therapy Few associated behaviors Slow speech rate Male	Unison reading (to slow speech) Slow, easy speech Improve eye contact	Short term goals met to slow speech and to maintain eye contact.
4	0 - 5 No other disorders Moderate-to-severe stuttering Slow speech rate Female	Home program Indirect therapy Video/audiotaping	Complete recovery from stuttering.
5	0 - 5 Primarily repetitions Negative family history No other disorders Mild stuttering No previous therapy Few associated behaviors Female	Home program Indirect therapy	Complete recovery from stuttering.
6	0 - 5 Male	Response-contingent time out Transfer/maintenance	Reduction in stuttering to "near zero level."
7	0 - 5 Severe stuttering No previous therapy Male	Response-contingent time out Transfer/maintenance	Reduction in stuttering to "near zero level."
8	School age No previous therapy Male	Electromyographic feedback Education Home program Self-monitoring Transfer/maintenance	Decreased muscle tension prior to speech. Decreased stuttering.

9	School age Negative family history Language, articulation disorders Severe stuttering Male	Control length, complexity Easy onset Identification Prolonged speech Slowed speech rate	Severity improved to mild-to-moderate. Long term goal met for identification. Short term goals met for controlling length and complexity and slow, easy speech. Short term goals not met for easy onset or decreased rate.
10	School age Articulation disorder Mild stuttering Previous therapy Male High motivation	Continuous voicing Easy onset Prolonged speech Slowed speech rate	Short term goals met for all procedures.
11	School age No other disorders Mild stuttering Male	Attitudes therapy Delayed auditory feedback Continuous voicing Easy onset Home program Identification Self-monitoring Slowed speech rate Transfer/maintenance Video/audiotaping	Long term goals met for use of speech targets to improve fluency, improve speech-associated attitudes, and self-monitoring.
12	School age Positive family history Articulation disorder Severe stuttering Previous therapy Male	Education Fluency enhancement Group therapy Identification Prolonged speech Slowed speech rate	Long term goal met for education. Short term goal met for slowed speech rate. Short term goals not met for identification or prolonged speech.
13	School age Articulation disorder Moderate stuttering Male High motivation	Fluency enhancement (choral reading to decrease rate) Modeling Slowed speech rate Soft articulatory contacts	Short term goals met for slowed speech rate and soft articulatory contacts.
14	School age Repetitions Articulation disorder Moderate stuttering History of previous therapy Few associated behaviors Male Above average motivation Extroverted	Slowed speech rate	Short term goals met.
15	School age Positive family history No other disorders Mild stuttering Previous therapy Male High intelligence	Stuttering modification Easy onset Home program Indirect therapy Modeling (parents) Regulated breathing Slowed speech rate Soft articulatory contacts	Short term goals met for easy onset, regulated breathing, and slowed speech rate. Short term goals not met for cancellation and soft articulatory contacts.

16	Adolescent No previous therapy Male	Electromyographic feedback Education Home program Self-monitoring Transfer/maintenance	Decreased muscle tension prior to speech. Decreased stuttering.
17	Adolescent No previous therapy Male	Electromyographic feedback Education Home program Self-monitoring Transfer/maintenance	Decreased muscle tension prior to speech. Decreased stuttering.
18	Adolescent Primarily repetitions Negative family history Severe stuttering Previous therapy Male	Delayed auditory feedback Continuous voicing Home program Identification Regulated breathing Self-monitoring Slowed speech rate Transfer/maintenance Video/audiotaping Smooth transitions Maintain eye contact Decrease associated behaviors	Long term goal met for identification. Short term goals met for DAF, regulated breathing, decreasing associated behaviors. Short term goals not met for transfer and maintaining eye contact.
19	Adolescent Previous therapy Male	Fluency shaping Attitudes therapy Identification Self-monitoring Slowed speech rate Transfer/maintenance	Long term goal met for improved fluency. Improved speech-associated attitudes. Decreased avoidance behaviors.
20	Adolescent Previous therapy Male	Fluency shaping Attitudes therapy Identification Self-monitoring Slowed speech rate Transfer/maintenance	Long term goal met for improved fluency. Improved speech-associated attitudes. Decreased avoidance behaviors.
21	Adolescent Previous therapy Male	Fluency shaping Attitudes therapy Identification Self-monitoring Slowed speech rate Transfer/maintenance	Long term goal met for improved fluency. Improved speech-associated attitudes. Decreased avoidance behaviors.
22	Adult Primarily repetitions Positive family history Cluttering Mild stuttering No previous therapy Few associated behaviors Fast speech rate Male Low motivation Introverted	Delayed auditory feedback Control length, complexity Easy onset Education Home program Modeling (clinician) Prolonged speech Regulated breathing Self-monitoring Slowed speech rate Transfer/maintenance	Short term goals met for DAF, controlling length and complexity, easy onset, prolonged speech, regulated breathing, self-monitoring, and slowed speech rate.

23	Adult Primarily repetitions Positive family history No other disorders Mild stuttering Previous therapy Slow speech rate Female Introverted	Control length, complexity Easy onset Home program Identification Prolonged speech Relaxation Slowed speech rate Transfer/maintenance	Long term goal met for identification. Short term goals met for controlling length and complexity, easy onset, and prolonged speech. Short term goals not met for relaxation, slowed speech rate, and transfer/maintenance.
24	Adult Positive family history No other disorders Mild stuttering No previous therapy Many associated Fast speech rate Male	Easy onset Home program Identification Reality training Regulated breathing Slowed speech rate Role playing to decrease associated behaviors Smooth transitions	Long term goals met for identification and reality training. Short term goals met for easy onset, prolonged speech, regulated breathing, decreasing associated behaviors, and smooth transitions. Short term goals not met for slowed speech rate.
25	Adult Primarily prolongations No other disorders Mild stuttering No previous therapy Male Low motivation	Home program Identification Prolonged speech Reality training Regulated breathing Soft articulatory contacts	Short term goals met for identification and reality training. Short term goals not met for prolonged speech, regulated breathing, and soft articulatory contacts.
26	Adult Severe stuttering Many associated behaviors Male	Stuttering modification Desensitization Education Intensive therapy Transfer/maintenance Acceptance Regain control of speech mechanism	Long term goal of improved fluency met, but fluency not maintained. Short term goals met in subsequent therapy for acceptance and regaining control of speech mechanism.
27	Adult No other disorders Mild Previous therapy Female Low motivation	Prolonged speech Video/audiotaping	Short term goal for prolonged speech not met.
28	Adult Moderate-to-severe Many associated behaviors Female	Intensive therapy Transfer/maintenance	Improved control of stuttering at conclusion of therapy. This improvement not maintained.
29	Adult Previous treatment Male	Control length Easy onset Regulated breathing Soft articulatory contacts Transfer/maintenance Video/audiotaping Cancellation	Long term goals met for all procedures.

30	Adult No other disorders Severe stuttering Previous therapy Male	Stuttering modification Delayed auditory feedback Continuous voicing Easy onset Home program Slowed speech rate Soft articulatory contacts Punishment to decrease interjections	Long term goal met for speaking at 100 syllables per minute. Short term goals met for cancellation, pull-out, easy onset, and decreasing interjections. Short term goals not met for DAF, home program, and use of slow, easy speech.
31	Adult Negative family history No other disorders Moderate stuttering Previous therapy Few associated behaviors Male High motivation	Control length, complexity Home program Prolonged speech Reality training	Short term goals met for all procedures.
32	Adult Positive family history No other disorders Previous therapy Many associated behaviors Male	Attitudes therapy Delayed auditory feedback Desensitization Easy onset Identification Regulated breathing Slowed speech rate Soft articulatory contacts Loudness control	Long term goal met for improving speech-associated attitudes. Short term goals met for decreasing rate with DAF, desensitization to core behaviors, easy onset, slowed speech rate, and soft articulatory contacts. Short term goal not met for regulated breathing.
33	Adult Positive family history Moderate severity Many associated behaviors Normal speech rate Male High intelligence High motivation Extroverted	Desensitization Control length, complexity Easy onset Identification Prolonged speech Breathing while pausing Slowed speech rate Soft articulatory contacts Transfer/maintenance Smooth speech Role play Improve transitions between sounds	Long term goals met for identification and improved fluency during role playing. Short term goals met for desensitization, pausing, prolonged speech, soft articulatory contact, transfer, smooth speech, and transitions between sounds. Short term goals not met for controlling length/complexity and slowed speech rate.

Note: Sources for ten of the case reports are below. The rest were clients at the Florida Atlantic University-Communication Disorders Center.

1 - Winslow & Guitar, 1995
4 - Guitar, Schaefer, Donahue-Kilburg & Bond, 1992
6, 7 - Martin, Kuhl, & Haroldson, 1972
8, 16, 17 - Craig & Cleary, 1982
19, 20, 21 - Blood, 1995
26 - Klassen, 1995
28 - Cooper, 1983
29 - Pill, 1988

A Case example of a bilingual evaluation: A Tutorial

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Enrollment of students in the United States, Australia, and the United Kingdom from varying cultural and linguistic backgrounds has significantly increased over the last few years (Australian Bureau of Statistics,1997; Bauman, 1996; Campbell, 1996; U.S. Department of Commerce, 1990). One can therefore assume that the changing demographics in these countries also indicates the changing home language of students entering schools today. Some students, especially those with limited English proficiency and limited exposure to mainstream classrooms, may have had little experience with the values, activities and other components of school life in the United States, Australia, or the United Kingdom. In addition, some speech-language pathologists (SLPs) may have had limited experience and training in evaluating these types of students. Because of this situation, culturally and linguistically diverse (CLD) students are frequently misdiagnosed as having language disorders when in fact they are only manifesting language differences (Roseberry-McKibbin, 1995).

The purpose of this article is to provide a framework for the school-based SLP in determining a language disorder versus a language difference in evaluating CLD students with no or limited English proficiency. A real-life evaluation of a bilingual, Hispanic male student in the United States serves as the case study tutorial. This article presents multiple, complex, and "real-life" variables that are involved in diagnostic decision making. The article also discusses and illustrates some "best practices" that can be easily implemented in the assessment of CLD students.

INTRODUCTION

Enrollment of students in the United States, Australia, and the United Kingdom from varying cultural and linguistic backgrounds has significantly increased over the last few years (Australian Bureau of Statistics,1997; Bauman, 1996; Campbell, 1996; U.S. Department of Commerce, 1990). One can therefore assume that the changing demographics in these countries also indicates the changing home language of students entering schools today. These students exhibit various levels of functioning within the context of the school culture; specifically, they are acculturating to the culture of the U.S., Australian or U.K. school system and they are also learning English. Some students from families and community backgrounds with different cultural perspectives from the dominant school culture may have had little experience with the values, activities, and other components of school life in the United States (Gutierrez-Clellen, 1996; Langdon, 1996). In addition, many speech-language pathologists (SLPs) may have had limited experience and training in evaluating CLD students with limited English proficiency (Roseberry-McKibbin & Eicholtz, 1994). Available information about evaluating CLD students is frequently presented in the form of general principles or recommendations (e.g., using a team approach, making naturalistic observations), but typically specific, concrete, practical, and immediately applicable suggestions are not given. Real-life case studies illustrating recommended principles are rarely utilized. Thus, school-based SLPs continue to use less than ideal practices when evaluating CLD students with limited English proficiency (Roseberry-McKibbin, 1995). The purpose of this article is to utilize the case study format to provide practical and immediately implementable suggestions for SLPs to utilize in determining a language disorder versus a language difference when evaluating a CLD student with no or limited English proficiency.

A real-life evaluation of a bilingual, Hispanic male student in the United States is presented as a case study which illustrates some of the multiple and complex variables that are involved in diagnostic decision making, specifically, deciding whether a student has a language difference or a language disorder. The article presents the reason for Francisco's (not his real name) referral, background information (i.e., the "Case Study Questionnaire") obtained from family members, information obtained from teachers (i.e., "Referral Checklist", "Classroom Checklist", "Classroom Processing Questionnaire", and the "Request for Intervention" form) and the results of evaluations performed by the evaluation team members (Refer to Appendix A for the Classroom Checklist and the Classroom Processing Questionnaire). The article integrates this information to recommend some "best practices" that can be easily implemented by school-based SLPs. In this case presented many best practices were implemented while several were not. This real-life evaluation is far from perfect, yet, it illustrates the complexities in performing a bilingual evaluation. The article discusses the best practices that were implemented and provides suggestions for how other best practices could have been implemented in an ideal assessment situation. The article concludes with specific, practical recommendations for how speech-language pathologists can optimally evaluate CLD students with limited English proficiency.

Reason for Referral

Francisco is a 12 year-old Hispanic male student enrolled in sixth grade (year six) at an elementary school in the U.S. Currently this school consists of greater than 30% Hispanic students. A speech and language evaluation was requested by the English as a second language (ESL) teacher because Francisco "has been learning English for 3 1/2 years, but continues to work well below grade level." It should be noted that the ESL teacher was well aware of the length of time that a bilingual student needs in order to acquire oral conversational abilities (two to three years) and academic language abilities in a second language (five to seven years) (Collier, 1987; Cummins, 1984). Francisco was classified in this school as being limited English proficient (LEP).

The evaluation team consisted of the school psychologist, the special education learning disabilities (LD) teacher, the ESL teacher, the general education classroom teacher, and the SLP. According to the "Request for Intervention" form, the evaluation team "felt that his difficulties with academic learning perhaps went beyond the fact that Spanish is his native language." This team also felt that Francisco did not seem to comprehend what he had read and was unable to retell or rephrase what he read. In addition, the team reported that Francisco experienced difficulty in applying learned information to new situations.

Background Information

At the time of this study, Francisco had been in school for five years (i.e., three and one half years in the U.S. and one and a half years in Mexico) and had reportedly enjoyed school. He is the oldest of three siblings. The other siblings are five and nine years old.

Francisco and his family moved to the U.S. where he had attended the elementary school in the U.S. community for three and one-half years. While at school, Francisco had consistently shown delayed language acquisition in Spanish and in English when compared to his siblings' progress and also when compared to other students from the same cultural, linguistic, and socioeconomic backgrounds. Francisco had received ESL services which included self-paced and one-to-one instruction in English, Language Arts, and Social Studies classes. It was reported by the school psychologist that, "Even with modified tests and assignments and ESL assistance at school, Francisco continued to have much difficulty with his academic skills."

Information obtained from the "Case Study Questionnaire" form from the father indicated that, in his opinion, "He is easily distracted on what he is doing and cannot learn well when he is studying." It was reported that Francisco becomes easily agitated. In addition, the father stated on the questionnaire that Francisco "could remember information right after he had explained it." However, he also said that, "five minutes later (he) cannot tell what was explained."

The developmental history information indicated that Francisco crawled at eight months, walked at 14 months, fed himself at 18 months and was toilet trained at 21 months. These milestones appear to be within the normal limits and ranges. He had a history of ear infections, at least one per year. Francisco also had a history of upper respiratory infections of one or two per year. The speech and language developmental history indicated that Francisco spoke his first words in his primary language of Spanish at two years of age and began to combine words in Spanish when he was three years old. Francisco began to speak in complete sentences in Spanish at 4 years of age. Hence, all speech and language development in his first language (i.e., Spanish) were significantly delayed.

Teacher Information

In order to obtain information about Francisco's communicative functioning in day-to-day situations, information was obtained from the following school forms for pre-referral assessment: "Referral Checklist", "Classroom Checklist", "Classroom Processing Questionnaire", and the "Request for Intervention" form. The school district created these forms, therefore, the reliability of these forms was substantiated only by verbal report given by the school principal and the school district superintendent.

The team wanted information about Francisco's daily communicative functioning based upon the observations of people who were familiar with him in multiple communicative situations over an extended period of time. The resulting information yielded the following details based on the observations of the general education classroom teacher and the ESL teacher, both of whom filled out the "Classroom Checklist" and the "Classroom Processing Questionnaire".

The "Classroom Checklist" covers areas of environmental strategies that the teacher may implement to effect change, organization strategies that the student may or may not possess, motivational strategies that the teacher may be using, presentation strategies that the teacher may be implementing, and curriculum strategies that may be used to improve the student's academic work.

The "Classroom Processing Questionnaire" is a questionnaire that covers strategies that are prerequisites for classroom success. The teacher completes the questionnaire by indicating whether the student rarely, sometimes, or usually performs the information processing tasks. This questionnaire covers general areas of storage, organization, acquisition, retrieval, expression, and manipulation. Two example questions from the "Classroom Processing Questionnaire" under the heading of "Expression" include: "Demonstrates oral fluency" and "Asks questions/gives answers related to the content."

Francisco spent approximately two hours per day in the ESL classroom for instruction in reading, language arts, and mathematics. He spent the remainder of the time in the general education classroom. The general education classroom was taught in English. The ESL classroom was taught mainly in English with approximately 20% Spanish language use. The ESL teacher had indicated this 20% estimate. Again, the ESL and general education classroom teacher filled out both questionnaire forms.

The general education classroom teacher, who has worked with Hispanic students for six years, indicated from the "Classroom Checklist" that Francisco did not set time limits for completion of class assignments, did not use the strategy of highlighting main facts in a textbook, had difficulty retaining specific information, required frequent repetition of information, failed to follow directions, had difficulty recalling information (especially without cues), omitted important details in restating information, had difficulty relating events in the proper sequence, had difficulty discriminating between words and symbols that sounded or looked alike, had difficulty in comprehending information presented orally, continued to have grammatic errors in speaking, was easily upset or frustrated, and had difficulty in content areas of reading, writing, and mathematics.

Information from the "Classroom Processing Questionnaire", indicated that in the general education teacher's view, Francisco had difficulties with following three or more step directions regularly, recalling previously learned information quickly, recognizing and recalling information over a period of time, obtaining information aurally or through hearing, obtaining information by reading, developing strategies to help recall information, counting and/or calculating automatically, participating in classroom activities, demonstrating oral fluency, asking questions and giving answers related to the content, applying learned information to new situations, and summarizing information. The general education teacher found him to have difficulty with 12 classroom skills. Hence, 41% (12/29) of skills observed in the general classroom posed problems to learning.

The ESL teacher indicated on the "Classroom Checklist" that Francisco could maintain a verbal conversation with others; however, she stated that Francisco was very limited in this ability in both his native language (Spanish) and in English. Francisco's emotional and social development were reported to be "somewhat below average socially". The ESL teacher also reported items from the "Classroom Processing Questionnaire" where Francisco had difficulty within the ESL classroom. The ESL classroom followed a looser structure than the

general education classroom. The class size ranged from five to twenty students. Up to three different sessions could be occurring simultaneously with the teacher, teacher aide, and helpers. Classroom lessons varied among reading, writing, mathematics, social studies, and history. Similar items that both teachers (general education and ESL) noted that Francisco had difficulty with are italicized.

Francisco had difficulty with *recalling previously learned information quickly*, sequencing information, *obtaining information by hearing*, *obtaining information by reading*, developing strategies to recall information, recalling sequential steps for a task, *demonstrating oral fluency*, *asking questions and giving answers related* to the content, applying information to new situations, summarizing information, identifying key concepts, and writing sentences close to grade level. Thus, the ESL teacher identified 12 problem areas and was in agreement with 8/12 (75% agreement) of these problem areas noted by the general education classroom teacher. The ESL teacher also identified 41% (12/29) of skills observed that posed problems to learning.

Thus, information obtained from the "Information Processing- Teacher Questionnaires" indicated similar performance in both the general education and ESL classrooms. It was consistently found that Francisco performed below average in expected skills that are highly related to school performance. In addition, it was noted that both teachers rated his performance equally low. Since almost one fifth of all exchanges in the ESL classroom can contain utterances in Spanish or combinations of Spanish and English (i.e., code-switching and code-mixing) (Brice & Perkins, 1997), it should be noted that Francisco's performance did not seem to be affected by use of either Spanish or English. It should also be noted that his oral language skills should have been adequate in English since he had surpassed the necessary time of two to three years to acquire oral language abilities (Collier, 1987; Cummins, 1984). Hence, at least in terms of his oral language abilities, Francisco should have been performing at a higher level than what was observed. In addition, he should have been performing at an academic level similar to that of peers from similar cultural, linguistic, and socioeconomic backgrounds. However, based on the ESL teacher's report, Francisco's academic skills were lower than those of similar peers. This is frequently an indication of a language disorder (Roseberry -McKibbin, 1995).

EVALUATION REPORTS

Francisco was evaluated by the school psychologist, the special education learning disabilities (LD) teacher, the ESL teacher, and the speech-language pathologist (SLP). Information and summaries from these reports are provided in the following paragraphs.

School Psychologist

The school psychologist administered the *Wechsler Intelligence Scale for Children, Third Edition (WISC-III)* (Wechsler, 1991) and the *Comprehensive Test of Nonverbal Test of Intelligence (CTONI)* (Hammill, Pearson, & Wiederholt, 1996). The verbal portions of the *WISC-III* were administered in Spanish with the assistance of a Spanish-English speaking teacher aide. The Verbal Scale IQ obtained was 56, the Performance Scale IQ obtained was 60, while the Full Scale IQ score obtained was 54. Francisco required "much prompting and encouragement when verbal responses were needed."

The *CTONI*, a nonverbal test of intelligence, requires listening and pointing responses from students. The *CTONI* scores indicated Quotient and Percentile scores as follows in Table 1:

Table 1. CTONI test results.

Subtest	Quotient	Percentile
Pictorial Nonverbal IQ	83	13
Geometric Nonverbal IQ	87	19
Nonverbal IQ	84	14

The school psychologist observed that Francisco fatigued quickly "as if the activities took a great deal of effort for him to complete." From the psychometric testing the school psychologist concluded that Francisco "worked to the best of his ability and his unusual scoring patterns were attributed to Francisco's bilingualism and difficulty processing language."

The results from the psychological testing indicated that Francisco performed better on the performance section of the *WISC-III* than on the verbal portions. This finding is expected due to the nature of the verbal test, i.e., measuring language abilities through the medium of language. However, his performance scale measures were greater than two standard deviations below the mean. Although these scores may not be a valid measure of his intellectual abilities, it did appear to indicate that Francisco had difficulties with tasks that seem to require the same cognitive processing abilities and performance abilities as found in the classroom. This was stated by the school psychologist in her report when she said that, "These tasks were also more like activities that he would do at school, probably requiring less explanation than the other more novel tasks."

Performance on the nonverbal test, the *CTONI*, yielded somewhat better results. Francisco's overall performance on the *CTONI* was within two standard deviations from the mean. Thus, concurrent validity between the *(CTONI Nonverbal IQ)* and *WISC-III Performance Scale IQ* was not established. The wide discrepancy of the scores (*CTONI* score of 84 versus the *WISC-III* score of 60) underscores the difficulty of validly using standardized measures of intellectual functioning with CLD children who are not represented in the tests' norming samples. The use of intelligence tests with CLD students is a controversial one (de Léon, 1995).

Special Education Learning Disabilities Teacher

The LD teacher administered subtests from the *Woodcock Johnson Test of Achievement-Revised (WJTA-R)* (Woodcock and Johnson, 1990). Francisco was tested in English. It seems that the LD teacher tested only in English due to time constraints. It should be noted that the authors of this article are strongly opposed to testing bilingual students only in English as this represents only one portion of their cognitive, linguistic, and educational abilities (de Léon, 1995; Cheng, 1991; Kayser, 1995).

The subtests that were administered included Letter-Word Identification, Passage Comprehension, Calculation, Applied Problems, Dictation, and Writing Samples. The grade equivalencies and standard scores age equivalencies can be seen in Table 2.

The LD teacher concluded that, although being assessed in English impacted Francisco's performance, he experienced difficulties not associated with his learning English as a second language. It appeared that the LD teacher based her results on the recommendations from the ESL testing. Specifically, he experienced difficulty in

Table 2. Woodcock Johnson Test of Achievement-Revised (WJTA-R) test results.

Subtest	Grade Equivalency	Standard Score
Letter-Word Identification	3.3	82
Passage Comprehension	2.0	67
Dictation	2.2	67
Writing Samples	1.7	55

applying strengths in the skills of calculation and letter-word identification to passage comprehension and applied problems. Hence, Francisco displayed difficulties in generalizing information to new situations (broad transference). A combination of ESL and resource room service provision was recommended by the LD teacher.

Results from the special education testing revealed that Francisco had low scores and a great deal of performance scatter. Francisco scored at the late second grade level for reading, the early third grade level for mathematics, and the late first grade level for written language skills.

The English as a Second Language Teacher

The ESL teacher administered the Spanish and English versions of the *Woodcock-Muñoz Language Survey* English and Spanish *(WMLS)* (Woodcock & Muñoz-Sandoval, 1993). Both the ESL teacher and Spanish speaking teacher aide administered the English and Spanish versions of the *WMLS*. This test measures broad English and Spanish language abilities, oral language, reading, and writing abilities. Both the Spanish and English results are presented to offer a comparison of Francisco's abilities in both languages (Refer to Tables 3 and 4).

The ESL teacher concluded that for both Spanish and English, Francisco's academic and oral language abilities when compared to ESL students at his grade level were limited, very limited, and/or negligible. The ESL teacher summarized by saying that for his grade level Francisco "performs overall CALP [academic language] tasks with 15% success in Spanish and with 12% success in English." On other similar tasks, however, for oral language Francisco "performs with 55% success in Spanish and 10% success in English." On the reading and writing tasks Francisco performed with 2% success in Spanish and 16% success in English. (The higher English performance in reading and writing may have been due to the fact that Francisco received all reading and writing instruction in English and Spanish is not supported as an academic subject in this school. This was verified by an interview with the ESL teacher.) Again, Francisco's language abilities in Spanish were substantially lower than those of peers from similar backgrounds, even in oral language.

Table 3. English Woodcock-Muñoz Language Survey test results.

Area/Subtest	Grade Equivalency	Percentile	Level
Broad English Ability	1.8	<1	2
Oral Language Ability	K.2	<1	2
Picture Vocabulary	<K.0	<1	
Verbal Analogies	1.4	5	
Reading/Writing Ability	2.6	2	2
Letter-Word Identification	3.6	13	
Dictation	1.7	<1	

Table 4. Spanish Woodcock-Muñoz Language Survey test results.

Area/Subtest	Grade Equivalency	Percentile	Level
Broad Spanish Ability	1.9	<1	2
Oral Language Ability	2.7	10	3
Picture Vocabulary	3.7	19	
Verbal Analogies	1.9	9	
Reading/Writing Ability	2.3	<1	1
Letter-Word Identification	1.1	<1	
Dictation	1.7	<1	

The Speech-Language Pathologist

The SLP administered the following tests and procedures with the assistance of the Spanish speaking teacher aide in translating: *The Token Test for Children (TTC)* (Di Simoni, 1978) (presented in Spanish as translated by the Spanish-English speaking teacher aide), the *Receptive One-Word Picture Vocabulary Test-Spanish (ROWPVT-S)* (Academic Therapy Publications, 1985), the *Expressive One-Word Picture Vocabulary Test-Spanish (EOWPVT-S)* (Academic Therapy Publications, 1983), and a type token ratio *(TTR)* obtained from a Spanish language sample (obtained with assistance of the Spanish-English speaking teacher aide). The language sample was administered in Spanish. Francisco's conversational partner was the Spanish speaking ESL teacher aide, whom Francisco had known for approximately three years.

The *Adolescent Pragmatics Screening Scale (APSS)* (Brice, 1992a; Brice, 1992b; Brice & Absalom, 1997; Brice & Montgomery, 1996) was also administered by three classroom teachers (i.e., the general education classroom teacher, the ESL teacher, and the ESL Spanish-English speaking teacher aide). The *APSS* is a rating scale of pragmatics typically observed in and out classrooms. The *APSS* was developed and has been trialled extensively with normal and language disordered monolingual and bilingual (Hispanic) students. The scale yields a Likert-type rating with one being highly appropriate and five being highly inappropriate. The *APSS* yields a Total Score and six Subtopic scores for rating.

The *APSS* was given to Francisco's classroom teacher, the ESL teacher, and the ESL teacher aide to administer. The ESL teacher aide judged Francisco's abilities in Spanish, while the other two teachers judged his pragmatics abilities in English. The teachers and aide made judgments independently of one another. The *APSS* ratings from the three teachers gave the following overall or Total Score results.

Table 5. Adolescent Pragmatics Screening Scale test results.

Teacher	Total Score Rating*
General classroom	3.25
ESL teacher	3.5
ESL teacher aide	3.5

* (1= highly appropriate, 5= highly inappropriate)

These scores indicated that Francisco's pragmatics skills were found to be consistently inadequate across settings and in both English and Spanish as independently evaluated by three professionals who were familiar with Francisco's classroom behaviors.

Results from the norm-referenced tests indicated that Francisco performed within average range on the receptive measures *ROWPVT-S*. His score on *ROWPVT-S* score was within two standard deviations from the mean. Francisco performed considerably poorer on the *EOWPVT-S*. A standard score could not be assigned based on the *EOWPVT-S* results because the raw score was too low. This would suggest that Francisco's expressive vocabulary was low. Results from norm-referenced tests were as follows:

Table 6. Speech-language test results.

Test	Standard Score
ROWPVT	81
EOWPVT	<55 (unable to assign a standard score)

Although Francisco's single-word expressive vocabulary appeared to be very low based on *EOWPVT-S* results, these results were not supported by the criterion- referenced language measure of the *TTR*. The *TTR* obtained from the language sample yielded a score of greater than 0.50, indicating a diverse expressive vocabulary for this sample.

It is interesting to note the lack of concurrent validity between the *TTR* and the *EOWPVT-S* results. Many experts (e.g., Cheng, 1991; Guiterrez-Clellen, 1996; Kayser, 1995; Kayser, Cheng, Gutierrez-Clellen & Anderson,1993; Langdon, 1996; Mattes and Omark, 1991; Roseberry-McKibbin, 1995; Quinn, Goldstein, & Peña,1996; Vaughn-Cooke, 1987) recommend the use of language samples as a valid measure of everyday communicative functioning, and state that language samples are more valid than standardized measures when CLD children are being assessed. The disparity between the *EOWPVT-S* and *TTR* results would support this claim, and lead SLPs to further question the use of standardized measures with CLD students.

SUMMARY OF THE EVALUATIONS

The combination of standardized and nonstandardized measures indicated that Francisco functioned below expected levels in both Spanish and English. It was seen that the use of nonstandardized measures appeared to be more valid in assessing Francisco's actual level of language skill; it has been well documented that the use of standardized tests discriminates against students from culturally and linguistically diverse backgrounds (Brice and Montgomery, 1996; Franklin & Saenz, 1994; Peña & Quinn, 1997; Roseberry-McKibbin, 1993). Therefore, SLPs may wish to place more weight on information obtained from nonstandardized measures in making clinical judgments.

From the case history information it was noted that Francisco's speech and language developmental milestones were delayed in his first language of Spanish. In addition, he had a history of ear and upper respiratory infections. Information from the teacher interviews, questionnaires, and other forms indicated a consistently low level of academic functioning in classroom tasks. The noted areas where Francisco had difficulties were observed in multiple settings by multiple observers and over a period of extended time. Thus, an ethnographic triangulation of his classroom abilities was achieved. The low abilities were apparent in both languages, indicating that Francisco's academic problems were based on something other than a lack of familiarity with English.

The standardized tests administered demonstrated low language abilities for English and Spanish and indicated that information alone was not valid enough to permit the SLP to make a diagnosis of language disorder versus language difference. However, the information obtained from the standardized tests indicated a low level of skills, performance scatter, and an inconsistent range of skills on academic-like language tasks (this was also noted in the samples and questionnaire forms). This low level of performance on the standardized tests indicated that some form of intervention was necessary because of the high possibility of academic failure. This is especially true as the language and classroom demands increase in middle school (Brice-Heath, 1986; Larson and McKinley, 1995; Paul, 1995; Simon, 1985). Thus, although standardized test results alone were not a strong or valid indicator of a language difference vs. a language disorder, they did give some indication of Francisco's difficulty with academic language, something that would affect his classroom performance on a daily basis.

The speech and language evaluation results indicated consistently low ability in using language (i.e., pragmatics) in both Spanish and English. It has been noted that pragmatic abilities demonstrate a strong correlation with academic success (Cazden, 1988; Cummins, 1984; Hymes, 1972; Paul, 1995; Simon, 1985). Therefore, based solely on the pragmatics results of this evaluation, Francisco was at-risk for academic failure

The informal measures (e.g., use of the language sample, teacher questionnaires, etc.) corroborated the information obtained through the formal tests. This was further established through the case-history information supplied by the father. A triangulation of standardized measures, informal measures, and parent information indicated that a language disorder was present.

RECOMMENDATIONS

The evaluation presented in this case study, like all evaluations, illustrated some best practices as well as some less-than-ideal practices for use with CLD students with limited English skills. The evaluation incorporated the following positive features. First, parental input was obtained in the form of a case history-type questionnaire (i.e., the "Case Study Questionnaire"). This case history information yielded foundational facts about Francisco's developmental delays in his primary language of Spanish, and revealed that he had difficulties remembering information in the home when his parents spoke to him in Spanish. Second, an attempt (although inconsistent) was made to evaluate the student in his primary language of Spanish. Third, the use of multiple classroom questionnaires ("Referral Checklist", "Classroom Checklist", "Classroom Processing Questionnaire", and the "Request for

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Intervention" form) represented authentic assessment in that the questionnaires evaluated real classroom expectations and the demands of communication in the classroom settings. Interviewing the teachers also implemented criterion-referenced measures which evaluated Francisco's daily communication skills in multiple, naturalistic, day-to-day situations. The criterion- referenced measures were completed by individuals who knew Francisco and were familiar with his communication and academic skills. Fourth, the evaluation was conducted over a period of time instead of a single and discrete point in time (Hamayan and Damico, 1991). Fifth, the evaluation was performed by an interdisciplinary team consisting of the SLP, the learning disabilities teacher, the psychologist, the English as a second language teacher, the ESL teacher aide, and the general education classroom teacher. Sixth, the team employed multiple measures consisting of standardized and formal measures along with informal measures of language, learning, and cognition. Seventh, the team compared Francisco to other students from his linguistic and cultural background. And finally, the evaluation team considered Francisco's length of time in English-speaking classrooms as an important variable in making a decision of language disorder versus language difference (Collier, 1987; Cummins, 1984). These processes made this evaluation more equitable and valid.

There were several less-than-ideal practices which took place during this evaluation. The reliance on standardized tests was not optimal. Francisco's case illustrates the principle that reliance on standardized tests will most likely yield invalid results, especially when used with students from culturally and linguistically diverse backgrounds (Roseberry-McKibbin, 1995; Vaughn-Cooke, 1987). In addition, using translated versions of existing tests may also give incorrect results. The use of dynamic and ongoing assessment procedures holds greater promise for obtaining valid and accurate measures of student abilities (Kayser, et. al. 1993; Peña and Quinn, 1996; Peña, Quinn and Iglesias, 1992; Quinn, Goldstein and Peña, 1996). In addition, testing only in English is strongly not recommended (de Léon, 1995; Cheng, 1991; Kayser, 1995).

Therefore, based upon available information in the current literature and the results of this case study, the following specific recommendations are given for best practices in evaluating CLD students with limited English proficiency:

1). Evaluate the student in her or his native language and in English (Anderson, 1994; Fradd and Weismantel, 1989).

2). Obtain information from classroom teachers and others who have frequent and sustained contact with the student (Anderson, 1994).

3). Conduct the evaluation over a sustained period of time (Hamayan and Damico, 1991).

4). Involve an interdisciplinary team of professionals in the Evaluation process (Cheng, 1991).

5). Use a variety of formal and informal measures (Anderson, 1996; Robinson-Zañartu, 1996).

6). Avoid reliance on formal, standardized measures as the primary indicators of a language disorder (Peña & Quinn, 1996).

7). Avoid translation of English tests into the student's primary language (Anderson, 1996).

8). Use informal measures which can include but not be limited to questionnaires that allow individuals (e.g., teachers) who are familiar with the student's daily performance to evaluate the student's communication skills in authentic, naturalistic, meaningful communication situations (Roseberry-McKibbin, 1993).

9). Compare the student to others from a similar linguistic and cultural background, including socioeconomic status (Taylor & Clarke, 1994). Include students who have had similar experiences and exposure to English, literacy, schooling, etc. (Roseberry-McKibbin, 1995).

10). Evaluate the language learning ability of bilingual students through use of dynamic assessment or other similar approaches that assess the student's ability to learn over time when provided with instruction (Lidz & Peña, 1996). This is especially critical for students who have not had many opportunities to learn in mainstream United States schools with mainstream United States school values.

11) Involve the parents in the assessment process (Langdon & Cheng, 1992). Utilization of case history information about the student's developmental milestones in the primary language is especially valuable in distinguishing a language difference from a language disorder.

CONCLUSION

The increasing numbers of CLD students with limited English proficiency in United States, Australian, and United Kingdom schools make it imperative that least biased assessment practices be implemented in order to validly distinguish language differences from language disorders. This case study has illustrated the use of some best practices, and has made specific recommendations for implementation of best practices that did not occur in this evaluation. When SLPs conduct assessments utilizing a team approach, parent input, and a combination of multiple evaluation procedures over a period of time in authentic communication situations, differentiation of language differences vs. language disorders in CLD students will become more valid and accurate.

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APPENDIX A

Classroom Checklist

What strategies have you tried to correct the problem? Please indicate those strategies you have applied to the problem and give an estimate of how long the strategy has been in effect in terms of days or weeks for those applicable items:

	Duration	Successful
Environmental Strategies		
1. Seating change	_____	_____
2. Isolation (How often?)	_____	_____
3. Change to a different hour/same teacher	_____	_____
Organization Strategies		
1. Setting time limits for assignment/completion during class	_____	_____
2. Questioning at end of each sentence or paragraph to focus on important information	_____	_____
3. Additional time to complete task or test	_____	_____
4. Highlighting main facts in the book	_____	_____
5. Organizing a notebook or providing a folder to help organize work	_____	_____
6. Asking student to repeat back directions	_____	_____
Motivational Strategies		
1. Sending home a daily progress report	_____	_____
2. Immediate reinforcement of correctresponses	_____	_____
3. Keeping graphs and charts of student'sprogress	_____	_____
4. Conferencing with student's parents	_____	_____
5. Conferencing with student's other teachers	_____	_____
6. Student reading lesson to aide, peer, teacher	_____	_____
7. Home/school communication system for work	_____	_____
8. Using taped reading materials in class	_____	_____
9. Student using taped materials at home	_____	_____
10. Buddy note taker (NCR paper)	_____	_____
Presentation Strategies		
1. Giving assignments both orally/visually	_____	_____
2. Taping lessons so student can listen again	_____	_____
3. Allowing student to have sample or practice test	_____	_____
4. Immediate correction of errors	_____	_____
5. Providing tests in smaller blocks of questions with wider spaces	_____	_____
6. Providing modified tests, fewer questions, simpler material	_____	_____
Curriculum Strategies		
1. Providing opportunities for extra drill	_____	_____
2. Providing study guide (outline)	_____	_____
3. Reducing quantity of material	_____	_____
4. Providing instructional materials geared to lower level of basic skills	_____	_____
5. Vocabulary flash cards	_____	_____
6. Vocabulary words in context	_____	_____

Are there any other strategies you have used that are not listed? If yes, please describe and was it successful?

_____

_____

South Central Educational Cooperative Service Unit, North Mankato, MN 1993.

APPENDIX A CONT'D

Classroom Processing Questionnaire

Student Name _____ Grade _____ Date _____

Teacher _____ Subject(s) _____

Please circle your response to each statement in regards to the above student.

Storage

Follows one to two step directions regularly	Rarely	Sometimes	Usually
Follows three or more step directions regularly	Rarely	Sometimes	Usually
Is able to recall previously learned material quickly	Rarely	Sometimes	Usually
Grasps simple word meanings	Rarely	Sometimes	Usually
Recognizes and recalls information over a period of time	Rarely	Sometimes	Usually

Organization

Hands in assignments on time	Rarely	Sometimes	Usually
Desk is organized most of the time	Rarely	Sometimes	Usually
Completes assigned work	Rarely	Sometimes	Usually
Sequences information	Rarely	Sometimes	Usually

Acquisition

Links new information to old	Rarely	Sometimes	Usually
Obtains information by hearing	Rarely	Sometimes	Usually
Obtains information by seeing	Rarely	Sometimes	Usually
Obtains information by reading	Rarely	Sometimes	Usually
Obtains information by touching	Rarely	Sometimes	Usually

Retrieval

Has appropriate response time when called on	Rarely	Sometimes	Usually
Develops strategies to help recall information	Rarely	Sometimes	Usually
Can name and label	Rarely	Sometimes	Usually
Associates sounds with letters	Rarely	Sometimes	Usually
Counts and/or calculates automatically	Rarely	Sometimes	Usually
Recalls sequential steps for a task	Rarely	Sometimes	Usually

Expression

Participates in class activities	Rarely	Sometimes	Usually
Demonstrates oral fluency	Rarely	Sometimes	Usually
Responds appropriately to non-verbal communication	Rarely	Sometimes	Usually
Asks questions/gives answers related to the content	Rarely	Sometimes	Usually

Manipulation

Applies learned information to new situations	Rarely	Sometimes	Usually
Summarizes information	Rarely	Sometimes	Usually
Interprets social cues	Rarely	Sometimes	Usually
Identifies key concepts	Rarely	Sometimes	Usually
Writes letters/sentences close to grade level	Rarely	Sometimes	Usually

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Voice and swallowing considerations after laryngotracheal reconstruction in children

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Laryngotracheal reconstruction has become an excellent surgical option to alleviate airway obstruction and offer decannulation for children with laryngotracheal stenosis. Unfortunately, not only does the primary disease affect laryngeal competence, but surgical therapy aimed to improve one function of the larynx (airway), may affect its other functions (phonation and swallowing). Using a team approach, the pediatric otolaryngologist often looks to the speech-language pathologist for their clinical expertise in the assistance of managing voice and swallowing problems in these children. We present a review of the salient considerations in planning and managing children before and after laryngotracheal reconstructive surgery.

INTRODUCTION

Laryngeal function has been an interest of the laryngologist for many years. The dynamics of an organ system that contributes in swallowing and voice production, while providing a conduit to the lower airway for breathing, makes it one of the most complex organ systems. Laryngotracheal stenosis in the past was a hopelessly debilitating condition often requiring life-long tracheotomy until the advent of laryngotracheal reconstructive procedures. The goal of laryngotracheal reconstruction is to enlarge the airway lumen in order to permit decannulation. Many techniques for laryngotracheal reconstruction have been developed that have improved breathing but not without implications to swallowing and phonation (Smith, Mortelliti, Cotton, & Myer, 1992). Any truly successful laryngotracheal reconstructive technique must consider the threefold function of the larynx and how each function impacts on the other functions.

DISCUSSION

The primary functions of the larynx are phonation, breathing, and protection of the airway during swallowing and phonation. Surgical therapy aimed at one function may affect the other functions. The primary goal of surgical laryngotracheal reconstruction (LTR) is to enlarge the airway and improve breathing to allow decannulation. In addition, the potential high morbidity and mortality associated with pediatric tracheotomy has made expedient decannulation desirable. Often times, the impact of LTR on phonation and swallowing is considered secondarily. However, improving breathing while obtaining decannulation does not have to come at the expense of phonation and swallowing, if all three functions are considered during treatment planning.

Primer to Laryngotracheal Reconstruction

Over the past century, the primary causes of laryngotracheal stenosis (LTS) have changed. Before the antibiotic era, inflammatory conditions such as diphtheria, syphilis and tuberculosis were the most prevalent causes of LTS. Later in the century, trauma became the more prominent cause of LTS due to the practice of prolonged intubation for ventilatory support. Presently, intubation injury is the most common source of LTS (Wiatrak, Cotton, & Holmes).

Management of LTS has also evolved to what are now our modern day laryngotracheal reconstructive procedures. The earliest and most conservative management of LTS is tracheotomy and observation. This is best suited for mild cases of LTS. In cases of severe LTS, this method may not only be ineffective but dangerous due to the high mortality rates that have been associated with long term tracheotomy (Wiatrak, Cotton, & Holmes).

In recent years, KTP and CO_2 lasers have allowed endoscopic management of mild to moderate LTS when observation alone is not adequate. Additionally, the laser may be used in conjunction with open surgical reconstructions in severe LTS.

There are multiple open surgical techniques for LTR which can be used individually or jointly, synchronously or metachronously for moderate to complete LTS. The simplest open procedure is the anterior cricoid split. This is a one-staged procedure in which the cricoid, first two tracheal rings, and the inferior third of the thyroid cartilage are divided vertically in the midline of the larynx. Next, a size appropriate endotracheal tube is placed in the larynx as a stent and removed after a week.

In more severe cases of LTS, the cricoid split may be combined with using grafts, most commonly costal cartilage, to re-expand the airway. Many times grafting LTR procedures require multiple stages because stents required to maintain the airway until the graft can heal completely are removed with a second operative procedure.

In severe or complete LTS, resection of the stenotic segment with primary anastomosis may be performed as long the stenotic segment is not too long. This procedure will not work if the anastomosis is under tension.

There are many other LTR techniques but the above mentioned procedures are the basis for which most LTRs are performed.

Swallowing

Dysphagia with or without aspiration is the most common swallowing problem seen after LTR. Most swallowing and aspiration problems are due to stent placement and are resolved when stents are removed. A history of preoperative swallowing difficulties may herald more severe postoperative complications and should be investigated before proceeding with surgery (Smith, et. al., 1992). A modified barium swallow, allowing visualization of anatomic and functional anomalies, may be an invaluable tool in the preoperative assessment and

post-operative planning.

Stenting, which is sometimes required for successful laryngotracheal reconstruction, frequently leads to dysphagia and aspiration. Stents are usually hollow and placed above the true vocal folds. This leads to aspiration and swallowing difficulties by interfering with laryngeal and epiglottic motion during the swallow. Patients with gastrostomy tubes may benefit from full feeding through the tube during the perioperative period.

Distinguishing the quality and type of dysphagia (i.e., solids vs. liquids) is important because their management is different. Aspiration to thin liquids can frequently be limited by thickening feeds. On the contrary, dysphagia due to postoperative edema, or narrowing of the pharynx due to suture lines or stents, may be improved by advancing feeds slowly from thinner consistencies up to solids.

There are various surgical techniques which the surgeon can utilize to limit swallowing problems. During operations requiring splitting of the posterior cricoid, the interarytenoid muscle is not divided completely to prevent loss of laryngeal competance. When stents are used, they should be capped at the upper end to limit aspiration. Stenting periods should be minimized to limit dysphagia from stent impingement on the esophagus (Smith, et. al., 1992; Smith, Marsh, Cotton, & Myer 1993). Stents may impinge on the esophagus by compression. If possible when the surgeon can limit stenting times, dysphagia will rapidly improve upon stent removal.

Voice

The next problem which should be considered before laryngotracheal reconstruction is phonation. Phonation difficulties may lead to abnormal vocal quality and poor speech intelligibility (Smith, et. al., 1993; Clary, Pengilly, Bailey, Jones, Albert, Comins, & Appleton, 1996). In a school-aged child, the effects of these problems are multiplied because of the potential impact on learning and development. The components of voice quality include pitch (frequency) and loudness (amplitude). Variations in frequency (jitter) and amplitude (shimmer) decrease the signal to noise ratio (Smith, et. al., 1993; MacArthur, Kearns, & Healy, 1994). This increased noise leads to hoarseness and roughness of the voice diminishing vocal quality.

Causes of phonation problems may be due to the original laryngeal injury and/or iatrogenic injuries during surgical correction (Zaizal, Loomis, Derkay, Murray, & Thomsen, 1991). Anatomic factors associated with poor voice outcome include: disruption and paralysis of the true vocal fold; anterior commissure blunting (Clary, et. al., 1996); arytenoid fixation (Zaizal, et. al., 1991), subluxation or impairment; and poor vocal fold approximation. Other non-laryngeal factors include high-grade stenoses, gastro-esophageal reflux disease (GERD), prolonged tracheal intubation or stenting, and scarring from multiple surgical procedures.

Prevention once again is the key to optimal management of phonation difficulties. Many of the anatomic causes cannot be prevented but may be recognized during pre-operative evaluation. On the other hand, iatrogenic sources of phonatory injury can be minimized by the surgeon's knowledge of the potential pitfalls of the various LTR procedures. During anterior LTR procedures, a complete laryngofissure should be avoided (Smith, et. al., 1992). Grafts placed high and too close to the true folds, as well as poor alignment of anterior commissure, can have a detrimental impact on speech. With posterior reconstruction, excessive graft width can limit approximation of the vocal folds (Zaizal, et. al., 1991).

LTR is a relatively novel area of study and there is much that needs to be learned in order to treat phonation and deglutition problems. Prospective and retrospective studies need to be performed to better identify the population at risk and to further delineate which changes in laryngeal structure and function arise from surgical manipulation versus disease. This will lead to further modification of techniques and improvement in future outcomes.

CONCLUSION

1) Phonation and swallowing disorders are a well recognized problem form laryngotracheal disease and it's surgical management.

2) Pre-operative evaluation by the speech-language pathologist is important and may identify factors that may contribute to poor voice outcomes.

3) Surgical technique during airway surgery has definite effects on laryngeal competence and must be adjusted to minimize untoward results while achieving surgical goals.

4) Laryngotracheal surgery requires a team approach to achieve the best possible results in children. The speech-language pathologist is an integral member of the team in evaluating and treating these patients. A comprehensive pre-operative assessment including a voice evaluation offers valuable information, including vocal pathology from surgical alteration versus patient disease, as well as the patient's base-line parameters. This allows for the best overall patient outcome and offers valuable information in treating future patients with this disease.

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Genetic hearing loss in children

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"The transmission of diseases by hereditary taint or family peculiarity is very manifest among the deaf and dumb." Heredity as a cause of hearing impairment in man as first acknowledged by otologist Sir William Wilde in the Irish census of 1857 (Wilde, 1853a, 1853b).

INTRODUCTION

Determining that a patient's hearing impairment is inherited can be difficult. Patients with hereditary hearing impairment do not necessarily present with a family history that makes the diagnosis obvious. Therefore, detecting that a patient's hearing impairment is inherited can depend upon maintaining a level of suspicion, and being clever in identifying the findings that lead to the conclusion that a genetic factor has caused the hearing impairment.

Speech pathologists and audiologists have a distinct advantage over many of their colleagues in the recognition of hereditary hearing impairment. This is because of their close working relationship with the otolaryngologist, and their familiarity with signs and symptoms insinuative of a genetic hearing loss. In working with the otolaryngologist, detecting even mild forms of head and neck dysmorphology suggestive of many hereditary disorders is possible (Lalwani & Gundfast, 1993).

The clinician that wishes to treat these patients must first gain trust from the patient and family. This is best done by emphasizing that an in-depth evaluation will require repeated visits and multiple examinations. Furthermore, expectations must be established with a clear understanding that the investigation may be futile. Confirming the diagnosis, however, may provide unyielding opportunity in management, treatment, and prevention. Available therapeutic intervention, along with genetic counseling, allows the patient excellent opportunity to integrate and become an active member in society. As well, identifying chromosomal abnormalities may further enhance our understanding of hereditary hearing impairment by providing additional information about head and neck embryogenesis and development. The potential identity of other genetic disorders and their gene location may further ensue (Lalwani & Grundfast, 1993).

This chapter reviews basic concepts of heredity and genetics that should be familiar to the practicing audiologist. More common causes of hereditary hearing impairment will be explored including signs and symptoms, diagnosis, and treatment.

HISTORICAL PERSPECTIVE

The concept of heredity as a cause of hearing loss was not accepted until the late 19th century (Ruben, 1991). Politzer popularized this concept in western otology in his 1882 text publication in stating: *"The most frequent causes of congenital deafness are hereditary, including direct transmission from the parents as well as indirect transmission from forefathers, and marriage between blood relations"* (Politzer, 1882). Other early authors (Hartmarm, 1881; Hartmann, 1880; Uchermann, 1869; Goldstein, 1933) further substantiated this hypothesis as they reported the recognition of deafness common along family blood lines. However, it was an otologist named William Wilde who fundamentally identified inheritance patterns which he included in his Irish census of 1857 (Wilde, 1853b). This popularized the idea of heredity as a cause of hearing loss in humans. He did have some reservations of his conclusions, such as that he only included congenitally deaf as potential for hereditary hearing impairment, progressive hearing loss was not considered possible to be hereditary, and he could not determine whether an infant was hearing impaired (Ruben, 1991). Most fascinating is that Wilde recognized and published patterns of inheritance as autosomal dominant, recessive, and sex linked before Mendal had published his data on peas in 1865. (Reardon, 1992a).

STATISTICS

Incidence and Prevalence

During the year 1985, Gorin and Cohen estimated that there were approximately 2500-4500 babies born profoundly deaf (Gorlin, Toriello, & Cohen, 1995a). Since genetics has been recognized as a cause of deafness, it has been estimated to be responsible for at least half of childhood cases (Reardon, 1992b; Chan, 1994). Thus, the prevalence of genetic deafness has been calculated as approximately 1 per 2000 population (Reardon, 1992a). As the clinician approaches the patient that is considered to have hereditary hearing loss, the impairment should be first sorted as if the loss is part of a syndrome complex (approximately 1/3 of genetic deafness) or non-syndromic hearing loss (approximately 2/3 of cases) (Grundfast & Lalwani, 1992). Those cases with no single specific etiology are often labeled cryptogenic.

Genetic deafness may be caused by a single genetic marker coding for the impairment, or may be part of an addition, deletion, transposition, or multifactorial abnormality within the chromosomal composition. Overall, the autosomal recessive form is the most common type accounting for approxi-

Table 1

TYPES OF GENETIC DEAFNESS	% OF DEAF POPULATION
AUTOSOMAL RECESSIVE	60-70%
AUTOSOMAL DOMINANT	20-25%
X-LINKED RECESSIVE	2-3%
CHROMOSOMAL MITOCHONDRIAL	<1%
MULTI-FACTORIAL	<1%

mately 60-70% of cases. Autosomal dominant is responsible for an additional 20-25%. X-linked recessive accounts for 2-3%. Chromosomal variation, mitochondrial inheritance, and multifactorial causes produce less than 1% of cases each (Reardon, 1992b)

DEFINITIONS

Congenital

Congenital means present at birth. This should not be confused with the terms "genetics" or "hereditary". Hearing impairment due to infectious etiology, if present at birth, is also considered congenital hearing loss. Hereditary hearing loss that is present in the newborn is considered congenital as well. Be mindful that hereditary hearing impairment can be congenital, but not all congenital hearing loss is hereditary and not all hereditary hearing loss is congenital. Some hereditary hearing impairments such as nonsyndromic autosomal dominant delayed onset sensorineural hearing loss begin later in life and therefore would not be considered congenital. Hearing loss in this hereditary hearing disorder usually occurs during adolescence (Leon, 1992).

Inherited

The terms "inherited" and "genetics" are essentially synonymous (Grundfast & Josephson, 1997). When a patient receives a gene from a relative that codes for the hearing loss, this is an inherited trait or hereditary. It is important to stress that not all syndromes are inherited. Some syndromes occur sporadically in nature without the passing of a particular gene from offspring to offspring. Goldenhars Syndrome is an example of this phenomenon. However, if a parent is affected, then the mode of inheretance is likely to be autosomal dominant (Grundfast, 1993).

Allele

Gregor Mendal studied the transmission of seven traits in pea plants. Each trait was noted to have two different forms of expression. For example, the pea plants were either short or tall, wrinkled or round, and yellow or green. Although it was not Mendal who coined the term "allele", the word is used to describe alternate forms in which a gene can exist (Grundfast & Josephson, 1997). A person who has two identical alleles for a gene is termed homozygous for that gene. Two different alleles is considered heterozygous for that gene.

Homozygous

A gene with two identical alleles which will be expressed indicate a homozygous gene. A person obtains one allele from each parent. If the allele obtained from each parent is the same, than the person is considered homozygous for that trait.

Heterozygous

Two different alleles for which a gene will be expressed indicates a heterozygous gene. If an offspring obtains a different allele form each parent expressing a gene or trait, than the person is considered heterozygous. In this case, the dominant allele will be expressed. However, the recessive allele may be passed to subsequent offspring.

Genotype

Genotype describes that the allele is present in a gene. The genotype of a particular individual may not be physically seen. For example, a person may have a gene or genotype for a hearing impairment, but because it is recessive in inheritance it may not be expressed. The genotype is the allele that may or *may not* be expressed in the offspring. Expression, or the phenotype, depends on the allele inherited from the other parent and/or if the allele is dominant.

Phenotype

The phenotype is the expression or the physical characteristic seen by the genotype. For any given genotype, for example eye color, the phenotype is that which is seen; brown or blue eyes. In the case of hereditary hearing impairment, the recognizable physical attribute seen is termed the phenotype.

Autosomal dominant

Autosomal dominant is the ability of an allele to be expressed whether a single or pair of alleles is present. It is autosomal because the allele is on one of the 23 autosomes and is not encoded on the X or Y sex chromosome. Again, it is dominant because the presence of a single allele will reveal a phenotypic expression. Typically, when an individual has the abnormal gene, 50% of the offspring will be affected. A vertical inheritance pattern can clearly be recognized in analysis of a family pedigree.

Autosomal recessive

In an autosomal recessive disorder, the gene is not on the X or Y sex chromosome, and the gene expression or phenotype is only seen if there are two identical genes on the chromosome; one from each parent. Therefore, in the case of hereditary hearing impairment, neither parent may have hearing loss, but both parents carry the gene for the hearing loss and thus each passes the gene along. Subsequent offspring may be afflicted with the impairment as well, thus, the importance of genetic recognition and counseling.

Typically 25% of offspring of an affected individual will inherit the disorder. The inheritance pattern is horizontal, meaning individuals from prior generations may not be affected; but siblings or relatives of the same generation may have the trait.

X-linked

X-linked indicates that the gene causing the disorder is located on the X chromosome. Most disorders found on the X chromosome are recessive. Therefore, there would need to be two identical genes for the expression of the impairment. However, in a male offspring, because the genetic make up is XY, the presence of a single abnormal allele on the X chromosome will be expressed. Whereby a female offspring must have a pair of alleles for the expression of the disorder. A single allele will encode her as a carrier. Although less common, the inheritance pattern of X-linked dominant is different because even in a female offspring, a single gene encoding the impairment will be expressed. If a female has an X-linked dominant hearing impairment, she will have the hearing impairment and both her sons and daughters have a 50% chance of inheriting the disorder.

Sporadic occurrence

The occurrence of an impairment that does not fit into the classic Mendelian inheritance patterns, with no identifiable genetic origin, is often considered sporadic occurrence. Goldenhars Syndrome(OAV) is

a typical example. Affected patients do not have any logical family inheritance pattern for the impairment (Grundfast, 1993).

Syndromic

A syndrome is defined as a set of symptoms which occur together. However, as opposed to a sequence, each of the symptoms are independent of the other. In addition, the presence of all features of a particular syndrome need not be present for a group of abnormalities to be recognized or classified as an already named syndrome. There are more than 200 syndromes that include deafness or hearing impairment as part of the syndrome complex (Gorlin, Toriello, & Cohen, 1995b). Be mindful that a syndrome may not necessarily be hereditary. For example, in fetal alcohol syndrome the impairment is not due to a genetic cause, although due to the constellation of findings it is classified as a syndrome.

Nonsyndromic

Being nonsyndromic, the occurrence of the disorder stands on its own without other features. Of the described hereditary hearing impairments, two-thirds are considered nonsyndromic. This means that two of every three patients with hereditary hearing impairment will have no other unusual feature distinguishing their hearing loss as hereditary in nature. Hence, many physicians will label such hearing impairment as cryptogenic (see cryptogenic definition below).

Sequence

A sequence describes a group of anomalies where one, two or three anomalies have occurred. For example, in Pierre Roban Sequence, a short mandible (micrognathia) causes elevation of the tongue and glossoptosis which inhibits closure of the palatal shelves and resultant cleft palate (Tomaski, Zaizal, & Saal, 1995). A sequence should not be confused with a syndrome.

Cryptogenic

Cryptogenic means obscure, doubtful or unascertainable origin (Grundfast & Toriello, 1999). Often times a newly diagnosed severe sensorineural hearing loss will have no identifiable cause on initial evaluation. The clinician may label such a patient as having a cryptogenic hearing loss. This should not go unexplored, and the importance of follow-up examination cannot be overemphasized. It may be difficult in the younger child to identify a noticeable syndromic cause of hearing impairment that may be more easily detected when the child is older. Repeat physical examination is therefore imperative and may offer a definative diagnosis.

HISTORY AND PHYSICAL EXAMINATION

Despite modern technology and the sophistication of newer computers and imaging modalities available, the old fashioned history and physical examination is still the best tool the physician has in establishing a diagnosis. This is especially true in the case of hereditary hearing impairment. A well thought out approach to the patient with suspected hereditary hearing impairment is laid out for the reader. In approaching such a patient, subtle clues may differentiate one syndrome from another. It is the astute clinician that will be able to differentiate and yield a correct diagnosis.

History

Specific causes for the hearing impairment may become evident when asking the following questions:

1). Is there a significant alcohol drinking history by the mother that may result in fetal alcohol syndrome?

2). Did mom have any infections during pregnancy, especially the first trimester such as rubella suggesting rubella syndrome?

3). After birth, did the newborn suffer from any of the following which could result in hearing loss, such as birth weight less than 1500 grams, asphyxia, hyperbilirubinemia, meningitis, cytomegalovirus, or other post-natal infection(TORCH)?

Family History

When obtaining a family history, the evaluating clinician must be careful when directing questions regarding hearing impaired family members. For example, in the history taking if there is a family member with hearing loss, an appropriate follow-up question should ascertain the cause of this family member's hearing loss. Many times a patient may offer information of a hearing impaired family member without offering the known cause.

Further questioning may identify an etiology of this family member's hearing loss such as cholesteatoma or meningitis which without further inquiry may have misled the clinician. However, if in history attainment, two or more family members are identified with hearing impairment, the physician should be highly suspicious of a genetic cause.

The following inquiry is warranted.

1). Does any family member have hearing loss, or wear a hearing aid of thirty years of age or less? If the answer to this question is yes, then the following should be asked:

2). Are there any family members in prior generations with widely spaced eyes, two different colored eyes, prematurely gray hair (that is predominance of gray hair before the age of thirty), or depigmented areas of skin? These are suggestive of Waardenburg syndrome.

3). Are any siblings or relatives affected with night blindness, tunnel vision, progressive loss of vision, or retinal disorders? Retinitis pigmentosa and ushers syndrome must be considered with an affirmative answer.

4). Do any family members or relatives have thyroid goiter? Pendred syndrome is supported with a positive response.

5). Do any family members have a history of heart arrhythmias or syncope? This may suggest Jervell and Lange-Nielson syndrome.

Of course, the clinician should ask other pertinent questions to complete the history, such as the existence of other medical conditions that may cause hearing loss. These include diabetes, autoimmune disorders, sarcoid, and others. In addition, an inquisition of present and past medications that may be cochlea toxic should be ascertained. After a thorough history, the physical examination may be performed.

Physical Examination

Although the physical exam is usually left to the physician, the astute audiologist may recognize certain findings that may be a clue suggestive of a hereditary disorder. A systematic approach with careful astute observation for even obscure abnormalities is of the essence in the investigation for a cause of hereditary hearing impairment. Even mild dysmorphology should be tabulated. Recognition of a set of findings may fit and lead to the diagnosis of a syndrome. Attention to the following by examination should be as follows:

Ears. Shape and location of pinnae, size of external canals, appearance of eardrum,shape of malleus, presence of preauricular pits, tags or cysts.

Eyes. Eyebrow confluence, distance between eyes, color of irides, extraocula movement, fundus, retinal pigmentation.

Face. Symmetry, shape.

Skin. Pigmentation, texture

Extremities. Carrying angle of arms, shape of fingers and toes.

Other Evaluation

Audiologic testing is often beneficial in determining the type and severity of hearing impairment. The classic cookie bite appearance described by some authors as indicative of hereditary hearing impairment may be misleading. This is because it does not correlate with syndromic hearing impairment, and a report by Liu and Xu (1994) has shown that audiograms of nonsyndromic hearing impairment are not appreciably different than compared audiograms of hearing impaired individuals from exogenous causes.

Radiographic evaluation with CT scan is often obtained by clinicians evaluating hereditary hearing impairment. It usually offers little to the diagnosis. However, an inner ear dysplasia such as a mondini deformity may be recognized. The increased association of inner ear malformations in patients with hereditary hearing impairment, such as with Pendrads syndrome (Grundfast & Toriello, 1999), has been reported but not clearly delineated. The value of CT scan truly is present in the pre-operative assessment of patients with syndromic hereditary hearing impairment. The CT scan can offer the surgeon anatomic detail of ossicular anomalies, a poorly developed mastoid cavity, and/or aberrant position of the facial nerve. This early identification can prepare the operator and prevent unwanted surgical complications.

Cytogenetics is not as of yet useful in detecting hereditary hearing impairment. This is primarily because cytogenetics does not have the capacity to detect point mutations; the cause of most cases of hereditary hearing loss. At present, the history and physical examination is still the best diagnostic tool in evaluating these patients.

It is worthwhile discussing the value of ordering a battery of tests in a futile search for the cause of hearing loss in an affected individual. Many clinicians send blood work for serology, chemistry, and hematology in hope that an abnormal lab value will support a diagnosis. It seems that without a good history supporting the value in ordering the laboratory study, a low yield in obtaining the result is apparent.

If there is a strong history of maternal promiscuity, than the value of syphilis serology may be substantiated. As is the value of obtaining a lyme titer in a patient who hikes or reports a history of a discrete rash suggestive of lyme disease. Therefore, with a thorough history and physical examination, selected adjunctive studies should be carefully obtained. A haphazard attempt by the evaluating clinician to find a needle in a haystack seems ineffective and expensive. This again emphasizes the potential gain of a history and physical re-examination in the patient with hearing loss of unknown etiology.

Specialty Consultation

Even the most experienced physician should never hesitate to obtain consultation in the evaluation of the difficult diagnosis. Being that there are approximately thirty syndromes and several infectious causes of hearing loss that have associated ophthalmologic findings, consultation with an ophthalmologist may provide invaluable information leading to a diagnosis (Grundfast & Toriello, 1999). Abnormalities such as retinitis pigmentosa suggestive of ushers syndrome, or interstitial keratitis indicative of cogans syndrome and syphilis, may be more difficult for the otolaryngologist to confidently diagnose. In addition, the ophthalmologist has an armamentarium of their own to help them confirm their suspicions of heredity as the cause of the eye disease.

The clinical geneticist may additionally be an asset in the identification of a syndrome not familiar to the otolaryngologist. This is because of their vast experience in detecting genetic diseases. In the case of hearing impairment of any cause, a genetic evaluation and consultation is often valuable for the patient. (See "Genetic Counseling" below).

MORE COMMON TYPES OF HEREDITARY HEARING IMPAIRMENT

Goldenhar Syndrome

(Singh, Malhotra, Singh, Mander & Gulati, 1994)

Also Known As: Oculo-Auriculo-Vertebral Dysplasia

Inheritance: Sporadic occurrence; thought to possibly be autosomal dominant with variable penetrance by some.

Gene Location: None located; sporadic occurrence

Test Confirming Diagnosis: Physical exam

Audiologic Findings: Conductive hearing loss

Typical Features:

-Facial asymmetry due to unilateral mandibular underdevelopment;

-Pinnae abnormalities including microtia

-Preauricular skin tags

-Vertebral dysplasia usually in the cervical region

-Coloboma

-Epibulbar dermoids

Apert Syndrome

(Hanieh & David, 1993)

Also Known As: Acrocephalo-syndactyly

Inheritance: Autosomal dominant; 1 in 150,000 live births

Gene Location: Unknown

Test Confirming Diagnosis: Physical exam

Audiologic Findings: Flat conductive hearing loss due to stapes fixation

Typical Features:

-Syndactylia

-Stapes fixation

-Craniofacial dysostosis

-Hypoplastic maxilla

-Proptosis

-Saddle nose deformity

-High arched palate

-Frontal prominence

-Exophthalmos

-Occasionally spina bifida

-Patent cochlea aqueduct on CT scan

Crouzon Syndrome

(Carinci, Avantaggiato & Curioni, 1994)

Also Known As: Craniofacial Dysostosis

Inheritance: Autosomal dominant

Gene Location: 10q

Test Confirming Diagnosis: Physical exam

Audiologic Findings: Conductive or mixed hearing loss in 1/3 of cases

Typical Features:

-Cranial Synostosis

-Exophthalmous with divergent squint

-Parrot beaked nose

-Short upper lip

-Mandibular prognathism

-Small maxilla

-Hypertelorism

-Premature closure of suture line with resultant mental retardation

Treacher-Collins Syndrome

(Dixon, 1995)

Also Known As: Mandibulofacial Dyostosis; Franceschetti-Zwahlen-Klein Syndrome

Inheritance: Autosomal dominant

Gene location: 5q

Test Confirming Diagnosis: Physical exam

Audiologic Findings: Conductive hearing

loss
Typical Features:
-Antimongoloid palpebral fissures with notched lower lids
-Malformation of the Ossicles with stapes usually spared
-Auricular deformities
-Canal Atresias
-Mandibular and malar hypoplasia
-"Fishmouth"
-Cleft lip and Palate-Sensorineural deafness

Pendred Syndrome

(Reardon & Tremblath, 1996)
Inheritance: Autosomal recessive in 8-10% of hereditary deafness.
Test confirming diagnosis: Perchlorate test
Audiologic Findings: Sensorineural hearing loss
Typical Features:
-Hearing loss
-Thyroid Goiter by puberty

Jervell and Lange-Nielson Syndrome

(Schwartz, Periti & Malliani, 1996)
Inheritance: Autosomal recessive
Test Confirming Diagnosis: EKG = prolonged QT interval
Audiologic Findings: Profound bilateral sensorineural hearing loss
Typical Features:
-History of syncopal episodes or drop attacks
-heart arrythmias
-Sensorineural hearing loss

Stickler Syndrome

(Kulkarni, Sureshkumar, & George, 1993; Rai, Wordsworth, Coppock, Zaphiropoulos, & Struthers, 1994)
Inheritance: Autosomal dominant
Gene location: 12q, 6p
Test Confirming Diagnosis: Physical exam
Audiologic Findings: Conductive, sensorineural or mixed
Typical Features:
-Marfanoid habitus
-Juvenile onset arthritis
-Severe myopia
-Retinal detachments
-Cataracts
-Prominent ankle, knee, and wrist joints
-Pierre Roban Sequence
-Midfacial hypoplasia

Alport Syndrome

(Pajari, Kaariainen, Muhonen, & Koskimies, 1996)
Inheritance: Autosomal dominant; 1% of hereditary hearing impairment
Gene Location: 2q
Test Confirming Diagnosis: Urinalysis
Audiologic Finding: Sensori-neural hearing loss
Typical Features:
-Progressive nephritis leading to renal failure
-Sensiruneural hearing loss
-Hematuria and Proteinuria

Table 2. Indications for Genetic Counseling

-Knowledge of medical, educational and psychosocial supportive services
-Assist in the diagnoses of hearing impairment
-Rule-out more complicated syndromes
-Help family adjust to a hearing impaired child
-Inform of risk of future offspring having hearing impairment
-Evaluate family pedigrees to obtain information for hearing impaired individuals
-Make recommendations for appropriate medical follow-up and consultations
-Identify available areas of active research on types of hearing loss

Waardenburg Syndrome

(Grundfast & San Agustin, 1992)
Inheritance: Autosomal dominant with variable penetrance; 7% of hereditary hearing loss
Gene Location: Type I - 2q; Type II - 3p
Test Confirming Diagnosis: Physical exam
Audiologic Findings: Sensorineural hearing loss (20% of patients)
Typical Features:
-Dystopia Canthorum
-Flat nasal root of the nose
-Confluent eyebrows
-Heterochromia irides
-White forelock
-Pigmentary abnormalities
-Diminished vestibular function
-Cleft lip and Palate
-Sensorineural hearing loss

Branchio-Oto-Renal Syndrome

(Llistosella & Pujol, 1996)
Inheritance: Autosomal dominant
Gene location: 8q
Test Confirming Diagnosis: Physical exam
Audiologic Findings: Usually sensorineural, maybe conductive hearing loss
Typical Features:
-Preauricular pits
-Branchial cyst and or fistula
-Sensorineural hearing loss
-Renal dysplasia and/or anomalies of the kidney collecting system

X-Linked Recessive Mixed Deafness with Perilymphatic Gusher

(Nance, Setleff, & Mcleod, 1971)
Inheritance: X-linked recessive
Gene Location: Xq
Test Confirming Diagnosis: Examiner's suspicion
Audiologic Findings: Conductive hearing loss
Typical Features:
-Conductive hearing loss

Autosomal Dominant Delayed Onset Progressive Sensorineural Deafness

(Grundfast, 1993)
Inheritance: Autosomal dominant
Gene Location: 5q
Test Confirming Diagnosis: Audiogram
Audiologic Findings: Sensorineural hearing loss
Typical Features:
-Conductive Hearing loss

GENETIC COUNSELING

The medical community often views deafness as a pathologic process with the strong intent to evaluate, diagnose, and intervene for cure and prevention." Social norms within the deaf society often consider deafness as a cultural and linguistic difference, not a medical disease (Amos, Israel, & Cunningham, 1991). Genetic counseling has become an accepted practice with strong clinical and social ramifications. The physician must understand the goals of genetic counseling as they pertain to each individual and their family. If the physician can adequately convey these goals to the patient, genetic counseling can be beneficial and informative for both the patient and physician.

In addition, genetic counseling can be advantagous for individuals with deafness of environmental etiology. This is because of the high incidence of assertive mating

amongst deaf persons (Schein, 1989).

Genetic counseling has become a separate medical specialty. Patients are given emotional support while encouraged in an individual decision making process. This is called "nondirective counseling". This allows the patient and family to make their own decisions while being provided with sound educational facts about hereditary hearing loss and its transmission to offspring. This approach to counseling has become the accepted method as it encourages individual needs rather than societal goals (Amos, et. al., 1991). It is important to understand that within the deaf community, deafness is considered an accepted cultural difference. As a matter of fact, many deaf individuals prefer to have deaf offspring (Amos, et. al., 1991).

Genetic counseling offers medical, psychological and social support without direct advice giving. It offers great personal benefits by increasing general knowledge regarding hereditary types of deafness, while developing strategies for providing appropriate genetic counseling for persons with all degrees of deafness.

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Evoked otoacoustic emissions as an objective screener for ototoxicity

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The ototoxicity that is sometimes caused by drugs used in treating life-threatening diseases, such as many of the myosin class of antibiotics (e.g., neomycin) and the platinum-based chemotherapeutic agent cisplatin, is irreversible. Ototoxicity is difficult to predict because it depends on a number of patient-specific factors, including the status of renal function, age, length of treatment, and interactions with other medications (e.g., diuretics such as furosemide) and other treatment modalities (e.g., radiotherapy). Since ototoxicity causes a permanent hearing loss, however, the only method of preventing it is to modify the treatment plan as soon as drug-induced dysfunction is discovered. It is, however, well-known that the younger the patient, the more likely it is that an ototoxic compound will produce a permanent hearing impairment (see review by Henley & Rybak, 1995).

It is well-established that irreversible injury and/or destruction of the elements that comprise the hearing, or cochlear portion of the inner ear, by ototoxins initially occurs to the outer hair cells (OHCs), with the damage then systematically progressing along the organ of Corti both apically and laterally to the inner hair cells (Wright & Schaefer, 1982). Because hearing loss leads to significant difficulties in a critically ill patient's ability to communicate effectively with care-givers, as well as with important family members and friends, it is essential that ototoxicity be identified as early as possible in the treatment regimen. As a consequence of early detection, medications can be substituted, doses changed, and/or the mode of administration altered, before the toxicity progresses to involve the mid- to low-frequencies that are so crucial for effective human communication.

It has long been known that ototoxicity initially involves the OHCs associated with the high-frequency portion of the audibility range. However, it has only been in relatively recent times that a test has been developed that specifically evaluates the functional status of these most fragile and sensitive of hearing receptors. Thus, with the discovery of evoked otoacoustic emissions, it became possible to determine the contribution of OHCs to normal hearing and to various forms of hearing impairment. Since then, both transient-evoked (TEOAEs) and distortion-product (DPOAEs) otoacoustic emissions have been used in the basic and clinical hearing sciences to preferentially evaluate the cochlea's OHC system. Based upon this initial knowledge, a number of commercial OAE devices have been developed over the past 10 years that test the status of OHC function in patients with hearing complaints. These instruments particularly take advantage of the considerable benefits of OAE testing, including the feature that these measures require only minimal compliance from the patient and thus are well-suited to evaluate the ears of either very young or very sick patients. In addition, because they are non-invasive, straightforward to measure, and are relatively inexpensive to test, they offer a number of advantages over the more traditionally used objective measure of the auditory brainstem response (ABR).

However, despite the general usefulness of emissions testing in diagnostic audiology and as a newborn hearing screener, other clinical applications that might benefit from the useful properties of OAEs have not yet been thoroughly investigated. For example, as noted above, it is well-established that the initial target of ototoxic compounds that produce irreversible hearing loss is the OHCs in the basal or high-frequency region of the cochlea. However, although emissions are ideal response measures for detecting ototoxicity because of their specificity for measuring OHC function, only a few reports of case studies have been published that relate the outcome of using evoked OAEs to detect ototoxicity in patients receiving drug therapy (Hotz, Harris, & Probst, 1994; Ozturan, Jerger, Lew, & Lynch, 1996; Zorowka, Schmitt, & Gutjahr, 1993). In the current marketplace, DPOAEs are assessed by instruments capable of testing up to and at least 8 kHz, while TEOAEs are measured to about 3-4 kHz in adults and 5-6 kHz in infants and children. Thus, DPOAEs are ideally suited to signal the earliest stages of drug-induced hearing loss at the highest audiometric-test frequencies. Interestingly, a number of experimental studies in animal models have shown that DPOAEs are capable of detecting high-frequency cochlear dysfunction involving either ototoxic antibiotics (Henley, 1994) or cisplatin (McPhee, Sperling, Madell, & Lucente, 1994).

As a means of systematically determining the benefits of using OAEs to monitor ototoxicity, our laboratory performed a pilot study (Ress, Sridhar, Balkany, Waxman, Stagner, & Lonsbury-Martin, 1999) aimed at evaluating the effectiveness of TEOAEs compared with DPOAEs in detecting cisplatin-induced changes in hearing ability in a series of 33 oncological patients, with a variety of advanced pulmonary and head and neck tumors. Given the sensitivity of OAEs to OHC function, a further aim of the project was to determine if the population-based emission measure detected drug-induced changes in cochlear activity before a clinical hearing loss was evident. The experimental protocol was designed to encourage excellent patient follow-up by testing on the day that patients returned to the hospital for their next round of chemotherapy. Thus, each record was acquired approximately three weeks after the previous drug treatment, immediately prior to the next infusion of cisplatin.

Overall, the OAEs, and particularly the higher-frequency DPOAEs between 4-8 kHz, detected drug-induced OHC dysfunction in 92% of the patients undergoing treat-

ment. In contrast, hearing thresholds for the conventional and/or extended ultra-high frequencies were elevated by cisplatin exposure in 82% of the patients. In some patients, the OAEs were more sensitive than measures of behavioral hearing to the earliest ototoxic changes in OHC function. In other cases, the ability of emissions to detect drug-induced changes in ears that exhibited pre-existing impairment was demonstrated. Moreover, the usefulness of using emissions testing towards determining the most efficacious habilitative treatment for a resulting ototoxic-induced hearing loss was also evidenced. It is interesting to note, too, that in most of the patients who exhibited baseline thresholds that were only behaviorally detectable by ultra-high frequency (UHF) audiometry, cisplatin-induced increases in these hearing thresholds were measurable along with reductions in the lower-frequency OAEs. In all, the results using emissions testing support the likelihood that these measures would make an ideal tool for detecting the onset stages of drug-induced hearing loss.

The following examples illustrate some of the benefits noted above of monitoring ear function with OAEs in patients receiving ototoxic chemotherapeutic treatment. Each figure illustrates pre-treatment (solid circles) versus post-treatment (open circles) comparisons of the results of tests of the clinical audiogram, DPOAEs, and TEOAEs. In two of the cases, the results of testing at the ultra-high frequencies extending from 9-20 kHz are also shown. Conventional audiograms were produced by a microcomputer-based audiometer (Virtual model 320), whereas the UHF audiograms were measured with the extended-frequency software available for the audiometer, along with its associated special earphones (Koss 4X/PLUS). All patients underwent immittance testing immediately prior to the emissions test using a computer-based tympanometer (Virtual model 310) to assess middle-ear pressure, static admittance, and ipsi- and contralateral acoustic-reflex thresholds at 1 and 2 kHz, and 1, 2, 3, and 4 kHz, respectively. It should be noted that, unless otherwise indicated, all patients had normal tympanograms at the time of emissions testing.

The DPOAEs were obtained using primary-tone levels of 65 and 75 dB SPL ($L_1 = L_2$) by a customized laboratory system (Otoscan v3.2), described in detail elsewhere (Whitehead, et. al., 1994). The DPOAEs were measured in the form of a DP-gram consisting of 32 geometric-mean frequencies of f_1 and f_2 ($f_2/f_1 = 1.22$), ranging from 0.8-8 kHz at 0.1-octave intervals. The TEOAEs were obtained using the conventional click-based protocol of the commercially available IL092 system (Otodynamics v5.6) that, along with producing a spectrum of the TEOAE, provided a reproducibility score for the frequency bands representing 1, 2, 3, 4, and 5 kHz.

Figure 1

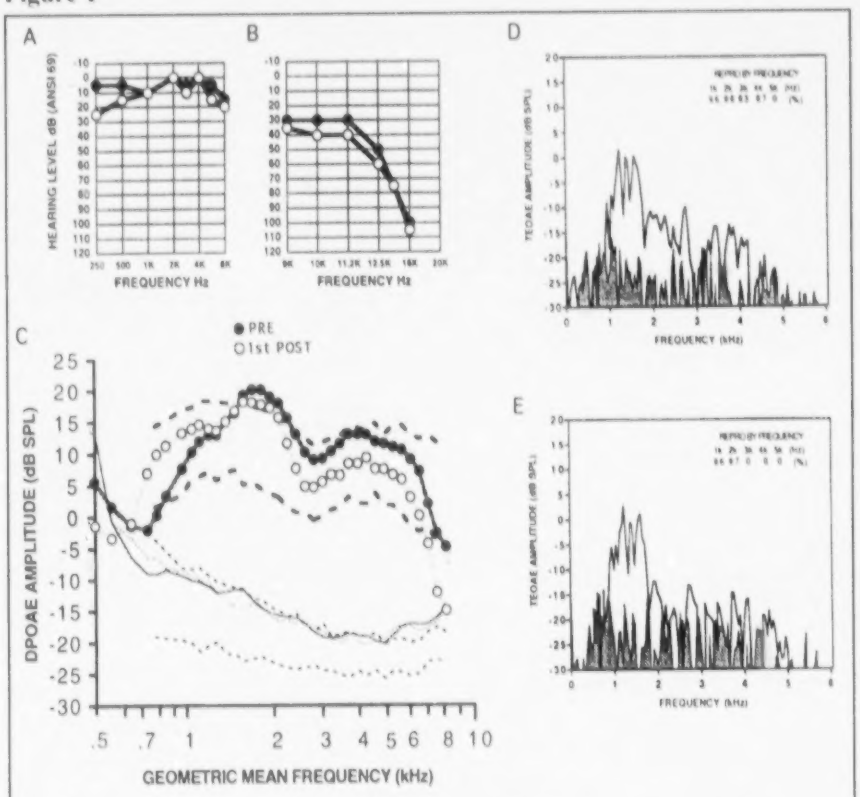

Figure 1: Pre- (solid circles) and post-treatment (open circles) hearing and evoked OAE records for the left ear of a 43 year-old female receiving cisplatin for a pulmonary adenocarcinoma. These findings illustrate the ability of OAEs to identify ototoxicity prior to the elevation of thresholds for the higher test frequencies of the conventional audiogram. **A**: Conventional behavioral audiogram showing normal hearing. Stippling indicates the region considered clinically normal. **B**: UHF audiogram showing 50-dB HL or better thresholds. **C**: DP-grams showing pre-treatment DPOAE levels within normal limits (upper set of bold dashed lines) compared to post-treatment emissions, which were reduced for frequencies >2 kHz, and at noise-floor levels (lower set of light dashed lines) for the highest test frequencies. **D**: Pre-treatment TEOAE spectrum showing a frequency distribution from about 1-4 kHz that represents a relatively normal adult pattern. **E**: Post-treatment TEOAE spectrum showing essentially the same frequency distribution as displayed in **D**, but with lower emission levels for frequencies from 3-4 kHz, as evidenced by the 0 values for these reproducibility indices.

Figure 1 shows the results of cisplatin treatment for a 43 year-old female with an adenocarcinoma of the left lung, who received a combination chemotherapy infusion of low-dose cisplatin (60 mg/m^2) along with the cytotoxin vincristine. The records for Fig. 1 illustrate the possibility of using OAEs for detecting the early signs of an ototoxic-induced change in cochlear function. For example, it is clear from the pre-treatment (solid circles) audiogram and DP-gram for Figs. 1A and C, respectively, that the patient's hearing in the conventional test range and DPOAE levels were essentially within normal limits. Similarly, Fig. 1B indicates that fairly normal hearing thresholds were also measured by UHF audiometry up to 14 kHz. Also, the control TEOAE test show in Fig. 1D showed a relatively normal adult frequency pattern from about 1-4 kHz.

However, following the initial chemotherapeutic dose, although hearing over the conventional test range was minimally affected (open circles), there was a clear elevation of thresholds of about 5-10 dB for

Figure 2

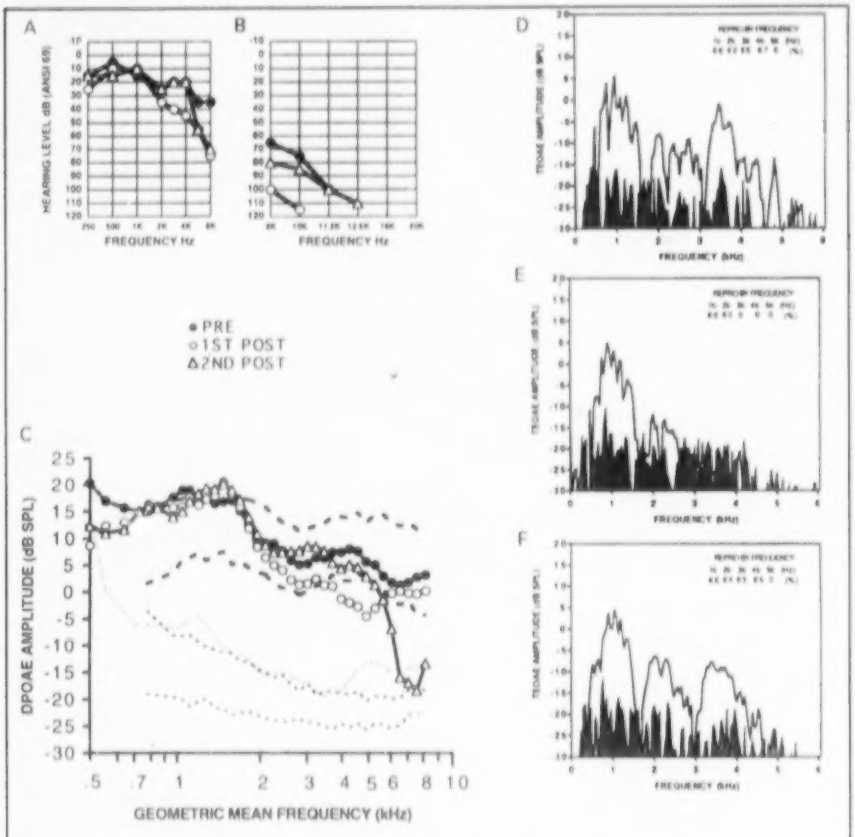

Figure 2: Hearing and evoked-emission results for the left ear of a 59 year-old female receiving cisplatin treatment for a non-small cell lung carcinoma. These results show that ototoxicity can be detected in ears with pre-existing dysfunction, and that sometimes, following a recovery period, improved performance can occur. Plots of both conventional (**A**) and UHF (**B**) audiograms obtained before (solid circles) and after #1 and (open circles) and #2 (open triangles) treatments. It is evident that the mild, likely presbycusis-related hearing loss above 2 kHz at baseline worsened after treatment #1, but showed little change after treatment #2 for frequencies >4 kHz and, in fact, improved for frequencies from 2-4 kHz. Similarly, audiometric hearing for the ultra-high frequencies worsened after treatment #1 to essentially immeasurable threshold levels, but improved somewhat following the second treatment. In **C**, the DP-grams show that, before treatment (solid circles), DPOAE levels were essentially within normal limits, with a tendency toward being at low-normal levels for frequencies >2 kHz. Following treatment #1 (open circles), DPOAEs decreased from their baseline levels, especially for frequencies from above 2 kHz. However, after treatment #2 (open triangles), DPOAEs were below their baseline levels for frequencies greater than about 3.5 kHz, and even fell to noise-floor levels for frequencies >6 kHz, at the same time that improved levels were noted for frequencies from about 2-6 kHz. The TEOAE plots at the right showed a considerable reduction in levels from baseline (**D**) following treatment #1 (**E**) for frequencies >1.5 kHz, and absent emissions for frequencies >3 kHz. However, the TEOAE plot in **F** obtained after treatment #2 shows improved levels for emissions greater than about 1.5 kHz. Note that the TEOAEs >3 kHz essentially returned to baseline levels as indicated by the values for the corresponding reproducibility indices at 3 and 4 kHz.

the UHF audiogram of Fig. 1B, especially from 9-12.5 kHz. Similarly, the DPOAEs (open circles) of Fig. 1C were reduced from baseline levels (solid circles) for frequencies above about 2 kHz and, in fact, decreased to noise-floor levels for the highest test stimuli around 7-8 kHz. Moreover, the post-treatment TEOAEs of Fig. 1E showed some reduction in emission activity around 3-4 kHz, as indicated by the reproducibility scores, shown at the top left of the plot, decreasing from about 83% and 87% respectively, to 0%. Together, the evoked OAE results indicate that emissions can provide early evidence of drug-induced decrements in the function of the peripheral ear in the absence of notable changes in hearing ability, particularly for the frequencies tested by conventional audiometry.

Interestingly, for the patient of Fig. 1, during the pre-treatment tests the pressure in this left ear was about -125 daPa so that a type C tympanogram was evident. Note that this negative pressure was associated with a slight elevation in thresholds, particularly for the lowest test frequency at 250 Hz. However, three weeks later at the follow-up test session, the tympanogram was a normal type A. At this time, low-frequency hearing thresholds were improved and the low-frequency DPOAEs for frequencies <1 kHz were also larger, as indicated by the open-circle curves in the plots of Figs. 1A and C.

Figure 2 illustrates the behavioral and OAE findings for the left ear of a 59 year-old female with non-small cell pulmonary carcinoma and metastasis, who received two relatively high-dose (100 mg/m^2) cisplatin treatments, in combination with the cytotoxic agents vincristine and 5-fluorouracil. The results of the hearing and OAE tests for this patient support the notions that emissions can detect changes in ears associated with previous behavioral impairment, and that ototoxic ears are capable of showing improved performance following a recovery period. The initial baseline audiogram (solid circles) for the left ear illustrated in Fig. 2A showed a mild hearing loss of about 35 dB HL for frequencies above 4 kHz that was likely due to presbycusis. The mild loss was reflected in the pre-treatment UHF audiogram of Fig. 2B, which was measurable only up to about 10 kHz, with thresholds =80 dB HL. However, the pretreatment DP-gram of Fig. 2C showed that, even though the emission levels for frequencies above 2 kHz were closer to the -1 standard-deviation limit than were those for frequencies below 2 kHz, they were still essentially within normal limits. Similarly, the corresponding baseline TEOAE record of Fig. 2D showed click-evoked emission activity that extended up to about 5 kHz.

Following the first dose of cisplatin (open circles), hearing thresholds became more elevated for test frequencies above 1 kHz for the conventional audiogram (Fig. 2A), and for all the testable UHF thresholds (Fig. 2B). Additionally, the emission recordings show that DPOAEs (Fig. 2C) were reduced from their control levels for frequencies from 2-8 kHz, and that the peaks of TEAOE activity observed above 3 kHz were abolished (Fig. 2E). The open triangles of Figs. 2A and B indicate that, after the second cisplatin treatment, hearing thresholds

Figure 3

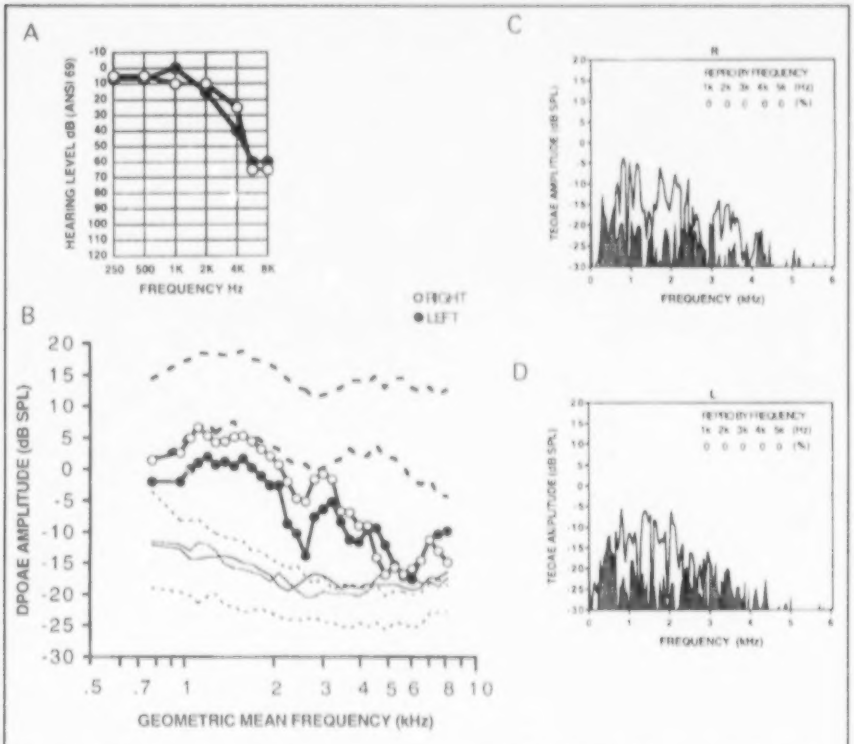

Figure 3: Hearing and evoked-emission test results for the left (solid circles) and right (open circles) ears of a 59 year-old female who received cisplatin as part of her anti-tumor treatment for ovarian cancer. These records show the benefits of OAE testing in detecting further drug-induced deterioration of ear function that has not yet been identified by routine pure-tone audiometry. **A** illustrates the bilateral high-frequency hearing loss associated with ototoxicity. The DP-grams of **B** indicate that DPOAE levels were abnormally low across the entire test range, particularly for the left ear, which exhibited lower levels than the right ear. The TEOAE plots for the left (**C**) and right (**D**) ears also reflected this asymmetry in that the frequency extent for the left ear extended only up to about 3 kHz, whereas the right ear exhibited responses up to ~4 kHz.

essentially stabilized at levels >35 dB HL for frequencies greater than 4 kHz. In addition, as shown in Fig. 2C, DPOAE levels continued to decrease for frequencies greater than about 6 kHz. Moreover, the TEOAE spectrum of Fig. 2F indicates that the high-frequency extent of emission activity was also reduced by the second dose of cisplatin. In combination, these examples presented in Fig. 2 support the notion that changes in ear function can be detected in patients who exhibit hearing losses prior to treatment with ototoxic drugs. In addition, these data also show that hearing thresholds and emission levels actually recovered to near baseline performance levels for frequencies between 2-4 kHz. Thus, findings for this patient illustrate the possibility that some improvement in both behavioral and peripheral ear function is feasible, at times, following chemotherapy.

The patient example presented in Figure 3 illustrates how evoked OAEs can provide additional information about ototoxic damage that assists the audiologist in devising a reasonable intervention strategy. In this case, the 59 year-old female with advanced epithelial ovarian cancer had undergone several schedules of chemotherapy that included cisplatin. From the clinical audiograms of Fig. 3A shown for the right (open circles) and left (solid circles) ears, a treatment-related permanent, bilateral hearing loss is evident for frequencies above 3-4 kHz. Given the high-frequency extent of the hearing loss, it was unclear why the patient unexpectedly complained about difficulties with distorted hearing and with carrying on conversations in the presence of background noise. However, when the patient's OAE records were reviewed, surprisingly, as apparent in Fig. 3C for DPOAEs, and in Figs. 3D and E for the TEOAEs of the right and left ears respectively, emission levels were abnormally low across the entire frequency range. Together, the OAE findings implied that the patient would likely benefit from a hearing aid-effected amplification of sound for frequencies less than about 4 kHz. Indeed, the patient was fully satisfied with such corrective amplification.

Monitoring for ototoxicity is highly recommended to ensure that fewer surviving patients are left with a hearing loss (American Speech-Language-Hearing Association, 1994). However, the practice of audiologic monitoring, unfortunately, is not one that is universally accepted or followed, primarily because of the lack of an adequate test that is simple and rapid to use. The present results support the notion that OAEs represent a test that makes it fiscally practical to monitor auditory function in even the most critically ill patients who are receiving potentially ototoxic treatments. Because the evoked OAEs reflect OHC activity preferentially, with known OHC injury, they are greatly reduced or even absent. Thus, evoked OAEs have properties that are ideal for ototoxicity-monitoring programs in which the primary goal is to identify the initial signs of a drug-induced reaction of the ear.

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The Near-total laryngectomy and the role of the speech-language pathologist

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The near-total laryngectomy is a surgical procedure for the treatment of laryngeal carcinoma that includes voice restoration. It generally incorporates the surgical removal of most of the larynx while preserving a narrow portion of tissue that connects the trachea and the pharynx. This portion usually includes a part of the uninvolved true vocal fold, its innervating nerve (the recurrent laryngeal nerve), and the unaffected arytenoid (Pearson, Keith, & Woods, 1983). The preservation of a laryngeal remnant and a pharyngeal mucosal flap coupled with adequate innervation are paramount to this surgical voice restoration technique.

The near-total laryngectomy is performed as a primary surgical procedure where the surgeon utilizes remaining laryngeal tissue and portions of the surrounding pharyngeal tissue to form a composite shunt (Pearson, 1981). This sphincteric tracheopharyngeal fistula or shunt is shaped somewhat like an inverted cone and lies between the trachea and the pharynx. The conical base is in the trachea and remains open, while the pharyngeal end or tip of the cone is similar to a one-way valve. Utilizing the remaining laryngeal remnant and placing it in a purse-string type shape forms the valve. This purse-string shaped valve remains closed at rest to allow for the preservation of swallowing. Exhaled pulmonary air passed into the shunt allows this shunt to open to produce voice. The vibrating segment or voice source differs between patients. Clinical observations have demonstrated variations of the actual sound source or vibrating segment. The vibrating tissues responsible for voice have been observed within the shunt itself, at the vocal fold remnant, in the pharynx and even in multiple places such as the vocal fold and pharynx (Pearson, personal conversation, 1987).

This procedure differs greatly from similarly named procedures, such as hemilaryngectomy or partial laryngectomy. It should also not be confused with the identically termed near-total laryngectomy procedure that is performed by the more recent surgical technique of transoral laser resection. The near-total laryngectomy procedure described herein is performed by traditional surgical techniques and does not incorporate the use of a laser.

Patient candidacy is determined by the surgeon and is based on many factors. Some of these factors can be determined preoperatively while other conditions can only be determined during the surgical procedure itself. Criteria for near-total laryngectomy consideration include a tumor size III, minimal pharyngeal metastasis and at least one mobile vocal fold (Woods, 1980). In general, some patients who were previously deemed candidates solely for a total laryngectomy procedure may also be candidates for the near-total laryngectomy procedure. The tumor location may be essentially anywhere in the larynx, unilaterally or bilaterally (as long as the aforementioned are persevered) as well as in the pyriform sinus if there is no posterior cricoid involvement (Pearson, et. al., 1983). Experience has also demonstrated that patients who have been irradiated in the laryngeal area are not ideal candidates. Previously radiated tissue tends to have reduced healing properties. The postoperative functioning of the shunt necessitates optimal healing to avoid postoperative complications and failure.

The successful rehabilitative management of the near-total laryngectomy is composed of many individuals including the surgeon, nursing personnel, American Cancer Society personnel, hospital discharge personnel, speech pathology, etc. The intention of the remainder of this paper is to provide a detailed guideline for the treatment of the near-total laryngectomy by speech pathology. It is recommended that upon the establishment of one's own protocol, one should thoroughly discuss the entire treatment protocol with each surgeon who will be performing the near-total laryngectomy procedure as individual surgeons may prefer variations in the suggested protocol.

The primary information in the following protocol for speech pathology intervention in the care of the near-total laryngectomy patient was developed by Proper and Pearson in 1987, in order to establish a consistent level of care for each near-total laryngectomy patient. Further development of the protocol was completed with Robert L. Keith, M.S., CCC, Speech Pathologist, Mayo Clinic – Rochester who made valuable suggestions to the establishment of this protocol.

The role of speech pathology in the treatment of the near-total laryngectomee commences pre-operatively with an educational consultation for the patient and his or her family. During this consultative session, the speech pathologist will be discussing the near-total laryngectomy, but may also need to discuss other surgical procedures such as the total laryngectomy and/or a supraglottic laryngectomy. The inclusion of several types

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of surgical procedures within the information provided to the patient pre-operatively is due to the surgical selection criteria that cannot be determined until the actual surgery. The surgeon will be able to provide the speech pathologist with the possible surgical outcomes for each patient. The speech pathology pre-operative consultation environment should provide ample opportunity for the patient and family to ask questions and should follow the same guidelines for any pre-operative laryngectomy consultation. In addition to the pre-operative speech pathology consultation session, there may also be a need to arrange either a personal or telephone pre-operative interview for the patient with a well-rehabilitated near-total laryngectomee. A post-operative laryngectomee hospital visitation may also be arranged at this time.

Post-operative speech pathology treatment is initiated approximately three days after surgery. However, a brief social visit from speech pathology the day after surgery is also encouraged. The initial treatment encounter is an additional educational session in which the information provided to the patient and family is specific only to the near-total laryngectomy procedure and rehabilitation. This is in contrast to the multiple procedure discussion that occurred pre-operatively. A post-operative hospital visit from a laryngectomee, trained by the American Cancer Society, should also be arranged, if it has not been previously completed. It is preferable that the trained laryngectomee visitor is a near-total laryngectomee, however, this is not always possible, therefore it is acceptable if the visitor uses tracheo-esophageal fistula speech. If visitation is made by an individual who utilizes tracheo-esophageal fistula speech, brief patient education should occur regarding the variations of the arriving visitor's tracheal-esophageal fistulization voice and rehabilitation aspects versus the patient's near-total laryngectomy voice. A video or voice recording of a proficient near-total laryngectomee speaker should be utilized to demonstrate the possible differences between his/her voice versus those of the laryngectomee visitor.

The initial treatment session should also incorporate an assessment of the patient's oral mechanism and voiceless consonant articulation as well as introducing the patient to an artificial laryngeal device. This device is to be utilized for verbal communication until the speaking fistula can be utilized for conversational voice. Thereafter, the artificial laryngeal device may be utilized as a permanent back-up communication system. Instructions for the use of the artificial larynx with the near total laryngectomee do not differ from that of a total laryngectomee.

Initial treatment with the voice shunt should occur between 5 and 7 days post-operatively. Speech pathology should always obtain direct surgeon approval prior to initiation of this stage of treatment. This session is accomplished with the tracheostomy tube removed and the stoma perimeter cleaned. Speech pathologists not comfortable with tracheostomy tube removal may want to coordinate this session during a tracheostoma care session or patient education session performed by nursing. However, speech pathologists working with laryngectomy patients of all types are encouraged to be trained and comfortable with all aspects of tracheostoma care. The initial voicing trial will be with speech pathology occlusion of the open stoma. The patient is instructed to inhale, the speech pathologist then gently occludes the stoma with a complete seal of the finger to stoma and the patient exhales through an open mouth in attempt to achieve initial voicing. At this time, the stoma is generally not healed and may contain sutures around its perimeter, therefore, use of gauze during stoma occlusion will assist in a complete seal. The force of exhalation used by the patient during these initial post-operative sessions should not be excessive. Voice may or may not be achieved. Voice achievement varies between patients. Voicing may be achieved during this initial session or not for several weeks. Specific techniques for achieving voice may include easy onset production of vowels or serial automatic speech tasks, such as counting, days of the week, etc. When employing this technique, it may be necessary to ask the patient to "whisper" to avoid excessive pulmonary or muscular effort. This technique of occluding the stoma during exhalation is highly beneficial in achieving voice for the first time. Should no voice be achieved, speech pathology may employ a brief one-time voicing trial with moderately excessive force in an attempt to achieve initial voicing, however, excessive force should not be utilized during continued trials during the initial post-operative week. The use of excessive force may reduce optimal healing of surgical tissue and therefore must not be initially used on a continual basis.

Independent of voice achievement, the patient should be trained in the occlusion of the stoma and attempts at voice trials. The speech pathologist should assist the patient in choosing the best single finger or thumb for stoma occlusion, which is preferably on the non-dominant hand. Once the patient is comfortable with stoma occlusion, the tracheostomy tube is replaced. The time the tracheostomy tube remains removed should be kept to a minimem to allow easy reinsertion of the tracheostomy tube. In rare cases, voicing may have been easily achieved on all trials with minimal to no patient effort. In such a case, the speech pathologist may want to attempt voicing trials with the tracheostomy tube in place. If successful upon speech pathology occlusion, then patient instruction may occur. Should the patient be successful producing voice without increased effort with the tracheostomy tube in place as well, surgeon approval should occur with regards to the amount the patient may use the voice shunt. Most patients however, do not achieve such effortless voice during the initial treatment sessions, therefore they should be educated with regards to self-practice. The patient is then instructed to attempt voicing via direct stoma occlusion 5-10 times upon all occurrences of complete tracheostomy tube removal (usually two times daily).

Once voicing has been achieved at any level, the patient should be educated to the fact that the quality, intonation, pitch and loudness will continue to improve over several months of conversational voice use.

Should voicing not be acceptable at the time of hospital discharge, speech pathology sessions should be arranged to occur at the same interval as surgeon visits for treatment of voice shunt utilization. The patient should be instructed to increase the number of voicing trials during post-operative weeks 3 and 4 as considerable stoma healing should be occurring which will allow for the tracheostomy tube to be left out for increasing periods of time. If no voice has been achieved by post-operative week four, an additional speech pathology visit is extremely important. Speech pathology intervention needed at this point should explore the variations in patient exhalation effort. To this point, the patient has only been trained in the use of relaxed or moderately increased exhalatory effort, which is generally sufficient for achieving voice. However, a minimum amount of patients will need to utilize increased exhalatory effort to open the shunt and achieve voicing for the first time. This increased exhalatory effort is used only to achieve initial voicing and should not be maintained with actual voice use. If voice has not been achieved with a satisfactory quality, there may be a complication with the shunt. A discussion regarding the complications of the near-total laryngectomy voice shunt will occur later within this

article.

Most patients should be able to achieve some form of shunt voicing generally around six weeks following surgery. However, communication may not yet be accessible due to stoma healing and tracheostomy tube use. Therefore, it may be possible to fit the patient with a flexible tracheostoma vent with a customized fenestration, which would allow for more effective stoma occlusion or valving and increased voice production.

Speech pathology intervention that is necessary following voice establishment is generally minimal. However, it may be necessary to continue to reinforce optimal stoma occlusion abilities and focus attention to the treatment of the patient's articulation, rate and various aspects of voicing (Keith, & Thomas, 1994). As aforementioned, appropriate stoma occlusion and voicing achievement includes obtaining and maintaining a complete finger/thumb to stoma seal with the non-dominant hand. Additionally, the patient should be instructed in appropriate respiratory and voicing coordination (or "valving" as referred to by Keith, 1994) to optimize voicing fluency while not producing unwanted extraneous sounds that may occur from inappropriate stoma occlusion. In the event the patient is unable to achieve an adequate stoma seal due to anatomical differences, then speech pathology will want to pursue the various avenues of treatment in this area as well. In addition to valving, treatment for appropriate speaking rate may also be necessary at this point in time. Many patients will speak too fast, either out of preoperative habit or in attempt to produce more words to decrease frequency of stoma occlusion. Other patients may speak slow or in a staccato-type manner to compensate for their new voice. Therapy for improved articulation should incorporate enhancement of general articulatory precision as well as voiced/voiceless consonant production.

Areas commonly overlooked in the rehabilitation process of the near-total laryngectomee are the use of a tracheostoma valve that would allow for hands-free communication and the use of a heat-moisture exchange system for the stoma. The voice of the near-total laryngectomee is probably more susceptible to the effects of reduced humidification than are other laryngectomy voices. This is because the fistula or the air passage is made of natural tissue versus that of silicone in the tracheo-esophageal prosthesis patient. Therefore, the speech pathologist needs to remind the patient of the need for continued appropriate tracheostoma care as prescribed by his/her surgeon, which will assure the patient of continued voice. Intervention in the use of a hands-free valve as well as a heat-moisture exchange system does not differ from the traditional methods speech pathology incorporates with tracheo-esophageal prosthesis users.

The advantages to a near total laryngectomy procedure are a decreased vocal rehabilitation time as compared to esophageal speech and complete elimination of patient care and maintenance as compared to the tracheo-esophageal puncture procedure. Pearson and Woods (1980) indicate additional advantages over tracheo-esophageal puncture including: air passage into the pharynx rather than the esophagus decreases air passage into the stomach; it is less susceptible to malfunction due to inattention; the shunt is "epithelialized and stable"; and the lack of prosthesis not only completely eliminates patient care but also eliminates the chance of the shunt closing. Improved vocal quality and prosody have also been noted as an advantage to the near-total laryngectomy procedure. Studies have compared a near-total laryngectomy voice to that of an excellent tracheo-esophageal puncture voice (Trudeau, 1987). Clinical experience has demonstrated the near-total laryngectomy voice may have a higher fundamental frequency, improved pitch variation and range as well as a vocal quality of a more even tone. The author's first experience with a near-total laryngectomee speaker, in 1987, was one of surprise as the elderly female's vocal quality was thought to be that of a slightly low pitch laryngeal speaker.

The disadvantages to a near-total laryngectomy procedure as compared to a total laryngectomy procedure, with or without a primary tracheo-esophageal puncture, include an increase in the technical demands placed on the surgeon, an increase in surgery time, reduced patient criteria standards, as well as technical complications with the shunt itself. As with most surgical procedures, the near-total laryngectomy procedure may have complications, which may interfere with speech pathology intervention. One common problem is the inability to achieve functional voicing despite all efforts by the patient and speech pathologist. There may be several anatomical reasons for this problem including continued edema, scarring in the fistula itself, the valve portion of the shunt not opening or being "too tight", etc. Another complication may be that the shunt is flaccid or "too loose", although this is not a problem for voicing as these patients generally have excellent voice from the onset, however, this problem may cause aspiration and the surgeon may request that no voice use occur. The surgeon manages these complications along with most complications involving the near-total laryngectomy.

In summary, the near-total laryngectomy procedure provides an alternate surgical option for the treatment of laryngeal carcinoma while providing improved voice with reduced patient care and effort for voice achievement. Speech pathology intervention techniques vary in the establishment of voicing and the procedure demands more of the speech pathologist with regards to their knowledge and abilities with tracheostoma care. However, the general role of the speech pathologist in the treatment of the near-total laryngectomee patient varies little from the role speech pathology plays in the treatment of the total laryngectomee patient.

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Manuscript contents considered for publication include medical speech-language pathology and audiology; instrumental procedures in the management of speech, language, hearing and swallowing; treatment strategies/efficacy; educational audiology; speech-language pathology and audiology in the schools; hearing aid fitting; aural rehabilitation electrophysiological methods; multicultural and diversity issues; aides, assistants and associates in the clinical setting; managed care strategy; total quality improvement; health care reform; preferred practice parameters; and others. Only previously unpublished manuscripts will be considered.

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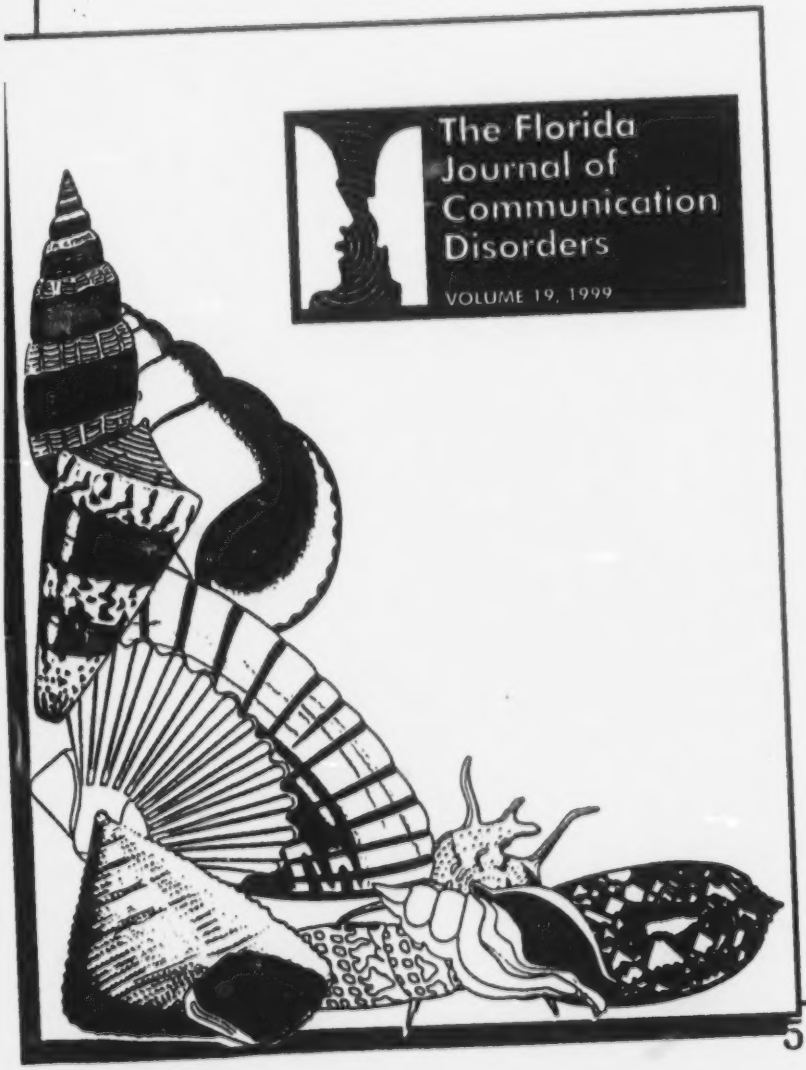

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The Reliability of the Kay Elemetrics Multidimensional Voice Program (MDVP) for acoustic analysis of the normal voice

1. According to the 1996 study by Bielamowicz, et. al., which of the following was declared to be the only comparable measurement across systems?
   a. shimmer
   b. SNR/NHR
   c. fundamental frequency
   d. jitter

2. The Kay Elemetrics MDVP is capable of displaying up to _____ parameters from a single vocalization.
   a. 35
   b. 45
   c. 31
   d. 33

3. When the analysis of variance was performed:
   a. no significant difference was found for Jitt as a function of day.
   b. no significant difference was found for Shim as a function of judge.
   c. no significant interaction between day and judge for NHR was found.
   d. all of the above

4. The results of this test indicate that MDVP can be considered a stable research and clinical tool for the assessment of disordered voice.
   a. true
   b. false

A Case study of an adolescent African American English dialect speaker with a language disorder

5. The selection of appropriate language assessment instruments is not a challenge facing speech-language pathologists when evaluating culturally and linguistically diverse (CLD) adolescents.

   a. true
   b. false

6. "Language deficits" is a term used to refer to language variations or styles of language systems used by a specific group of people.
   a. true
   b. false

7. Most nonstandard-English dialect speakers have disordered expressive language skills.
   a. true
   b. false

8. Adolescents who do not have appropriate expressive language skills are at increased risk for academic failure.
   a. true
   b. false

9. Assessment protocols for nonstandard-English adolescent speakers should include language sampling of communication skills across different conversational partners.
   a. true
   b. false

Matching stuttering therapy procedures with clients: A Preliminary investigation

10. Which of the following statements is supported by the case reports examined in this study?
   a. Indirect therapy is the treatment of choice with school-aged children.
   b. The ability to self-correct errors is important for both school-aged and adolescent clients.
   c. For adults, the best results occur with biofeedback therapies.
   d. Clients can be successfully matched to treatments on the basis of family history of stuttering.

11. Which of the following techniques is utilized in indirect therapy for stuttering?
   a. a speech model that includes a reduced rate of speech
   b. a speech model that includes increased pausing
   c. institution of turn-taking activities
   d. all of the above

12. Which statement best summarizes the present state of treatment for stuttering?
   a. Clients overall make progress despite a shortage of data on how to match treatment techniques to individuals.
   b. The existence of objective measures of progress has allowed clinicians to determine the worth of specific therapy approaches.
   c. The existence of subgroups has allowed clinicians to determine the worth of specific therapy approaches.
   d. Therapeutic progress is rare.

13. Based on the case reports cited, which of the following appears to be the most important element to include in a treatment plan for a school-aged child who stutters?
   a. decreased rate
   b. easy onset with light articulatory contacts
   c. a program for transfer/maintenance
   d. education about speech

14. Based on the case reports cited, which of the following appears to be the most important element to include in a treatment plan for the adolescent who stutters?
   a. clinician monitoring of fluent speech
   b. clinician monitoring of attitudes
   c. client self-monitoring
   d. client self-education

A Case example of a bilingual evaluation: A Tutorial

15. What length of time does it typically take an English language learner to acquire oral proficiency in English?
    a. 6 months
    b. 1-2 years
    c. 2-3 years
    d. 3-5 years

16. What length of time does it typically take an English language learner to acquire academic proficiency in English?
    a. 2-3 years
    b. 3-5 years
    c. 5-7 years
    d. 8-10 years

17. What two forms revealed significant information about the subject's classroom skills that was concurrently validated by his teachers.
    a. the Classroom Checklist and the Classroom Processing Questionnaire
    b. the Referral Checklist and the Request for Intervention Form
    c. the Classroom Checklist and the Referral Checklist
    d. The Classroom Processing Questionnaire and the Request for Intervention Form

18. The *CTONI* and the *WISC-III* tests yielded discrepant scores when compared to each other.
    a. true
    b. false

19. Which of the following is NOT one of the suggested best practices for evaluating culturally and linguistically diverse students who are limited in their English proficiencies?
    a. Evaluate the student in his or her native language and in English.
    b. Conduct the evaluation over a sustained period of time.
    c. Rely on formal, standardized measures as the primary indicators of a language disorder.
    d. Avoid translation of English tests into the student's primary language.

Voice and swallowing considerations after laryngotracheal reconstruction in children

20. Currently, the most common cause of Laryngotracheal stenosis is:
    a. infection
    b. intubation injury
    c. tumor
    d. pappilomatosis

21. Most symptoms of dysphagia in children who have undergone LTR are related to:
    a. stent placement
    b. vocal fold paralysis
    c. decreased base of tongue retraction
    d. GERD

22. Dysphagia for solids after LTR is most likely due to:
    a. vocal fold paralysis
    b. GERD
    c. post-operative edema
    d. decreased base of tongue retraction

23. All of the following are possible causes of dysphonia after LTR except:
    a. arytenoid fixation
    b. vocal fold paralysis
    c. anterior commissure blunting
    d. decreased base of tongue retraction

Genetic hearing loss in children

24. Pierre Roban represents which type of disorder?
    a. syndrome
    b. x-linked
    c. sequence
    d. autosomal dominant

25. The pattern for Goldenhars syndrome is:
    a. x-linked
    b. autosomal recessive
    c. sporadic occurrence
    d. autosomal dominant

26. Apert syndrome is typically associated with what type of audiogram?
    a. hi-frequency SNHL
    b. normal audiogram
    c. cookie bite
    d. flat, conductive hearing loss

27. Pendred syndrome is characterized by hearing loss and what other common symptom?
    a. thyroid goiter
    b. strabismus
    c. acoustic neuroma
    d. bifid uvula

28. Which of the following syndromes are not associated with SNHL?
    a. Allport
    b. Branchio-Oto-Rand
    c. Treacher-Collins
    d. Jervell & Lange-Rivelson

Evoked otoacoustic emissions as an objective screener for ototoxicity

29. When an ototoxic-drug reaction is discovered using hearing tests, what steps can be taken to prevent further hearing loss?
    a. change the method of administration
    b. change the type of drug
    c. change the dosage
    d. all of the above

30. Measures of evoked OAEs have the potential of being detectors of ototoxicity that are more sensitive than ABRs because:
    a. the equipment is less expensive
    b. they can be tested more quickly
    c. they more specifically measure the status of outer hair cell function
    d. the instrumentation is easier to use

31. In adult ears, TEOAEs can be typically tested up to about:
    a. 4 kHz
    b. 2 kHz
    c. 8 kHz
    d. 6 kHz

32. Mild middle-ear conduction problems can:
    a. reduce low-frequency emissions
    b. enhance low-frequency emissions
    c. abolish high-frequency emissions
    d. none of the above

33. DPOAE levels measured as a function of frequency, at constant levels of the primary tones, are conventionally referred to as:
    a. DPOAE audiogram
    b. DP-gram
    c. DP response/growth function
    d. $2f_1f_2$ gram

34. The conventional methods of eliciting TEOAEs is with:
    a. tonepips
    b. tonebursts
    c. two pure-tone stimuli applied simultaneously
    d. clicks

35. In a normal hearing ear, the following frequency range should exhibit the initial drug-induced changes in function using DPOAE or conventional audiogram tests:
    a. 0.5-1 kHz
    b. 6-8 kHz
    c. 4-6 kHz
    d. 2-4 kHz

The Near-total laryngectomy and the role of the speech-language pathologist

36. What cannot be the vibrating segment for voice in a near-total laryngectomy?
    a. vocal fold
    b. pharynx
    c. esophagus
    d. shunt

37. Which situation would reduce patient candidacy for a near-total laryngectomy?
    a. stage III tumor
    b. only one mobile vocal cord
    c. tumor location
    d. pre-operative radiation treatment

38. Post-operative initial voicing trials with the near-total laryngectomy shunt should occur in:
    a. 5-7 days
    b. 14 days
    c. 4 weeks
    d. 6 weeks

39. Which of the following would be the least likely to be used by a near-total laryngectomee?
    a. tracheo-stoma valves
    b. esophageal speech
    c. heat-moisture exchange system
    d. electro-larynx

40. If no voice is achieved, when should the speech-language pathologist ask the surgeon to intervene?
    a. 5-7 days
    b. 14 days
    c. 4 weeks
    d. 6 weeks

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Home Study Answer Sheet

Please circle the letter of the correct answer to each question. (The answer sheet and registration form may be photocopied.)

1.	a	b	c	d	21.	a	b	c	d
2.	a	b	c	d	22.	a	b	c	d
3.	a	b	c	d	23.	a	b	c	d
4.	a	b	c	d	24.	a	b	c	d
5.	a	b	c	d	25.	a	b	c	d
6.	a	b	c	d	26.	a	b	c	d
7.	a	b	c	d	27.	a	b	c	d
8.	a	b	c	d	28.	a	b	c	d
9.	a	b	c	d	29.	a	b	c	d
10.	a	b	c	d	30.	a	b	c	d
11.	a	b	c	d	31.	a	b	c	d
12.	a	b	c	d	32.	a	b	c	d
13.	a	b	c	d	33.	a	b	c	d
14.	a	b	c	d	34.	a	b	c	d
15.	a	b	c	d	35.	a	b	c	d
16.	a	b	c	d	36.	a	b	c	d
17.	a	b	c	d	37.	a	b	c	d
18.	a	b	c	d	38.	a	b	c	d
19.	a	b	c	d	39.	a	b	c	d
20.	a	b	c	d	40.	a	b	c	d

Learner Assessment

Rating Scale: 1 = Strongly Agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly Disagree

This activity provided me with useful information	1 2 3 4 5
This activity has contributed to my professional growth.	1 2 3 4 5
This activity provided the knowledge and skills to make a difference in my work.	1 2 3 4 5
I will incorporate the proficiencies gained from this activity into my work.	1 2 3 4 5
After this activity, I feel the need for additional information about the topic.	1 2 3 4 5

Comments _____

_____

_____

Thank you for your participation.

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